Study of Impacts Caused by Exempting the Maine Turnpike and New Hampshire Turnpike from Federal Truck Weight Limits

Appendix A: Weigh-in-Motion (WIM) Station Data Details

Weigh-in-Motion Station (WIMS) data

For this study, data was extracted from two Weigh-in–Motion stations (WIMS) installed on the turnpike in Maine and from one on the turnpike in New Hampshire. Data is also available from another eight non-turnpike WIM stations in Maine that will be used as needed to supplement the turnpike WIMS traffic profile. WIMS record a variety of statistics for each vehicle passing over sensors imbedded in the pavement, including:

- Number of axles;
- Gross vehicle weight (GVW);
- A calculation of equivalent standard axle load (ESAL P2.5, SN5);
- Vehicle speed.

The WIM stations in Maine and New Hampshire were first installed early in 2001. For this analysis records for every vehicle with 5 or more axles were extracted. The time period of the records is from the beginning of station operation through the end of October 2002. The total number of records exceeds 8 million for Maine (for all ten Maine stations) and nearly 2.5 million in New Hampshire.

All WIM station records for vehicles with 5 or more axles were imported into an ACCESS database and the most recent complete year of data was extracted for each station. A full year of representative data was available for each station, with the exception of one Maine non-turnpike station, where the dataset fell only a few days short of a full year. This data was then 'filtered' to capture only 5 axle and 6 axle 'combination' tractor-semi-trailer (TST) trucks (class 9 for 5 axle, class 10 for 6 axle). Average annual daily values were then derived from the annual data sets.

The Exhibits on the following pages contain:

- A summary of Average Daily Traffic (ADT) at the WIM stations (**Exhibit A-1**).
- Graphics (**Exhibits A-2** through **A-7**) showing vehicle counts and resulting ESALs for the turnpike WIM stations; first by total counts for all 5 and 6 axle combination trucks passing the station, then by direction, then by # of axles.
- Detailed statistics for each station (**Exhibits A-8** through **A-10**); the introduction to this detail section contains explanations of the data organization, which also applies to the graphs and summary table.

In all cases, the primary organization of the data is by loaded GVW category:

- *below exempt wt* – loaded GVW below exempt weights;
- *exempt weights* – 5 axle with loaded GVW between 80,000 and 88,001 lbs., or 6 axle with loaded GVW between 80,000 and 100,001 lbs.;
- *above exempt wt* – loaded GVW above exempt weights.

To assist visual comparison, the graphics show the proportion of vehicles **at exempt weights** at the <u>bottom</u> of the bars, then vehicles **over exempt weights**, and finally vehicles **under exempt weights** at the <u>top</u> of the bars. All tables list weight categories in their natural order: first vehicles under exempt weights, then exempt, then over exempt.

Exhibit A-1: Summary of WIMS Average Daily Traffic

Average Annual Daily Traffic - by Direction

	STATION	direction	VEHICLE AADT below exempt	VEHICLE AADT EXEMPT	VEHICLE AADT over exempt	VEHICLE AADT total	ESAL AADT below exempt	ESAL AADT EXEMPT	ESAL AADT over exempt	ESAL AADT total	MILLION LBS AADT below exempt	MILLION LBS AADT EXEMPT	MILLION LBS AADT over exempt	MILLION LBS AADT total
Turnpike	Central ME Turnpike	north	627	**145**	135	**907**	322	**454**	732	**1,509**	28.4	**12.8**	14.1	**55.4**
	Central ME Turnpike	south	729	**192**	73	**994**	631	**562**	352	**1,545**	38.6	**16.8**	7.5	**62.8**
	South ME Turnpike	north	1,696	**101**	24	**1,820**	1,005	**296**	129	**1,430**	81.0	**8.9**	2.4	**92.4**
	South ME Turnpike	south	1,365	**465**	143	**1,974**	1,061	**1,414**	735	**3,211**	71.9	**39.2**	14.5	**125.6**
	NH Turnpike	north	1,930	**161**	88	**2,179**	1,099	**496**	525	**2,119**	85.1	**13.8**	9.1	**108.0**
	NH Turnpike	south	1,916	**348**	169	**2,433**	1,651	**1,084**	902	**3,638**	98.7	**30.0**	17.3	**146.0**

Average Annual Daily Traffic - ALL Directions

	STATION	direction	VEHICLE AADT below exempt	VEHICLE AADT EXEMPT	VEHICLE AADT over exempt	VEHICLE AADT total	ESAL AADT below exempt	ESAL AADT EXEMPT	ESAL AADT over exempt	ESAL AADT total	MILLION LBS AADT below exempt	MILLION LBS AADT EXEMPT	MILLION LBS AADT over exempt	MILLION LBS AADT total
Tpk	Central ME Turnpike	ALL	1,356	**337**	208	**1,901**	953	**1,016**	1,084	**3,053**	67.0	**29.6**	21.6	**118.3**
	South ME Turnpike	ALL	3,061	**566**	167	**3,794**	2,066	**1,711**	864	**4,641**	152.9	**48.1**	17.0	**218.0**
	NH Turnpike	ALL	3,847	**509**	257	**4,612**	2,750	**1,580**	1,427	**5,757**	183.8	**43.8**	26.4	**253.9**

percent of station total (ALL directions)

	STATION	direction	VEHICLE AADT below exempt	VEHICLE AADT EXEMPT	VEHICLE AADT over exempt	ESAL AADT below exempt	ESAL AADT EXEMPT	ESAL AADT over exempt	MILLION LBS AADT below exempt	MILLION LBS AADT EXEMPT	MILLION LBS AADT over exempt
Tpk	Central ME Turnpike	ALL	71.3%	**17.7%**	10.9%	31.2%	**33.3%**	35.5%	56.7%	**25.1%**	18.3%
	South ME Turnpike	ALL	80.7%	**14.9%**	4.4%	44.5%	**36.9%**	18.6%	70.1%	**22.1%**	7.8%
	NH Turnpike	ALL	83.4%	**11.0%**	5.6%	47.8%	**27.4%**	24.8%	72.4%	**17.3%**	10.4%

Exhibit A-2: Turnpike WIM Stations – ADTT

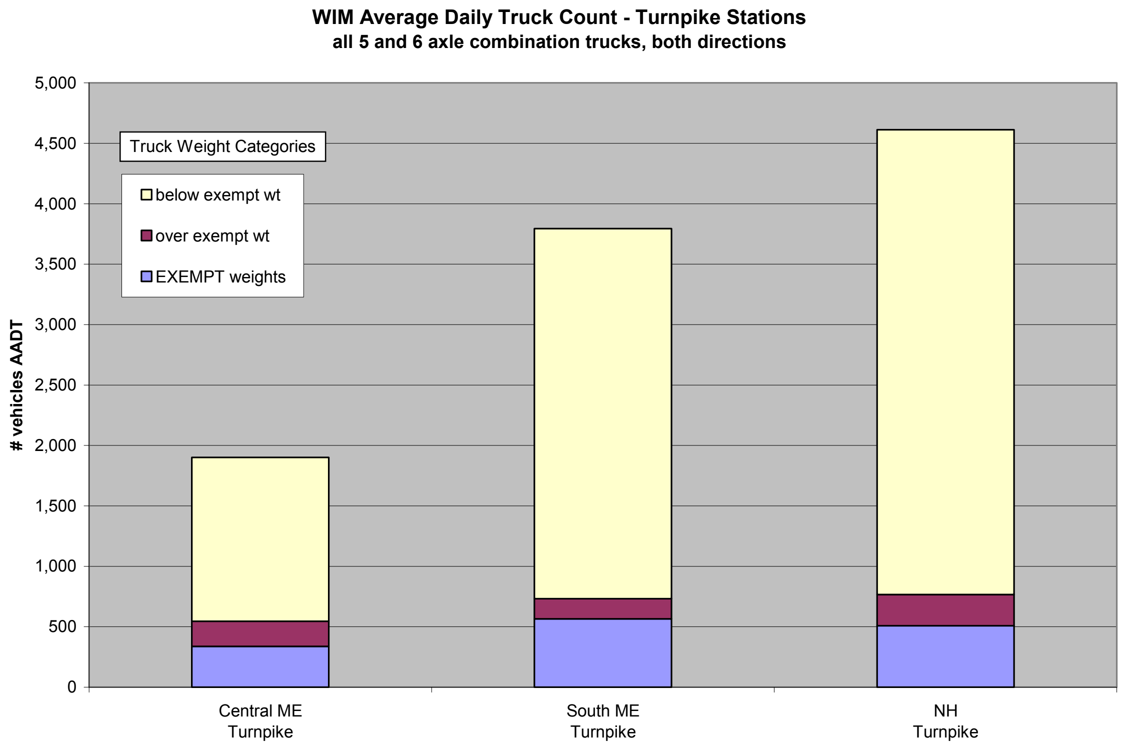


Exhibit A-3: Turnpike WIM Stations – ESALs

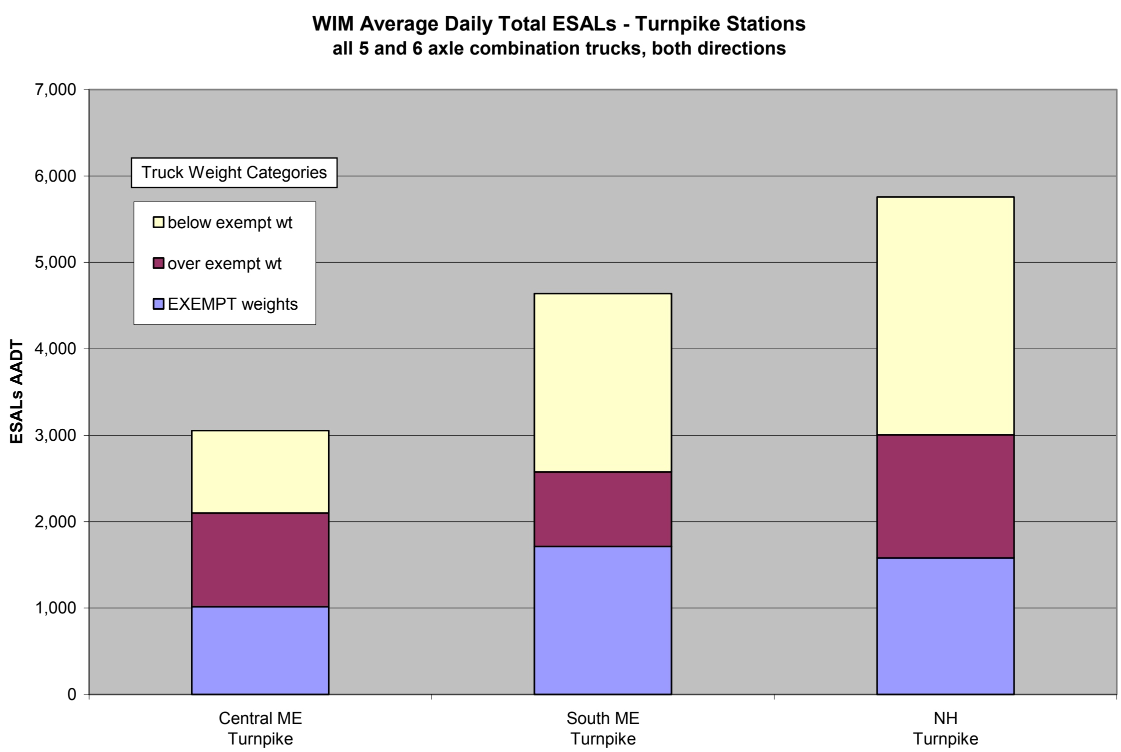


Exhibit A-4: Turnpike WIM Stations – ADTT by Direction

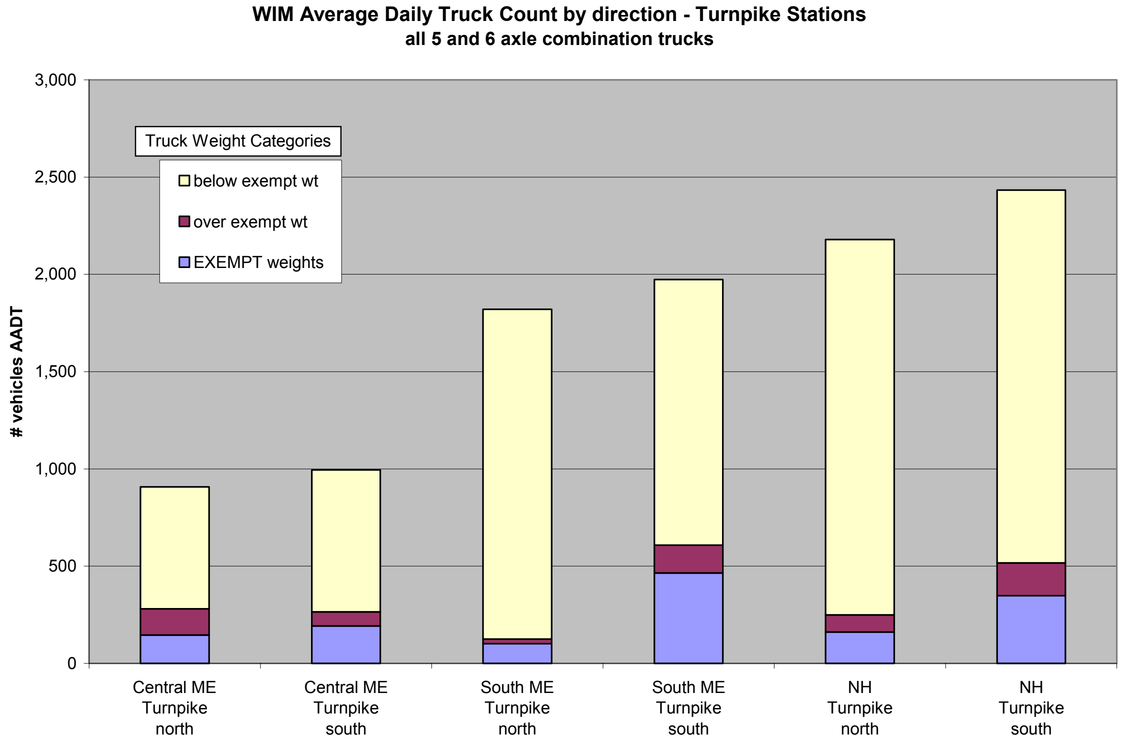


Exhibit A-5: Turnpike WIM Stations – ESALs by Direction

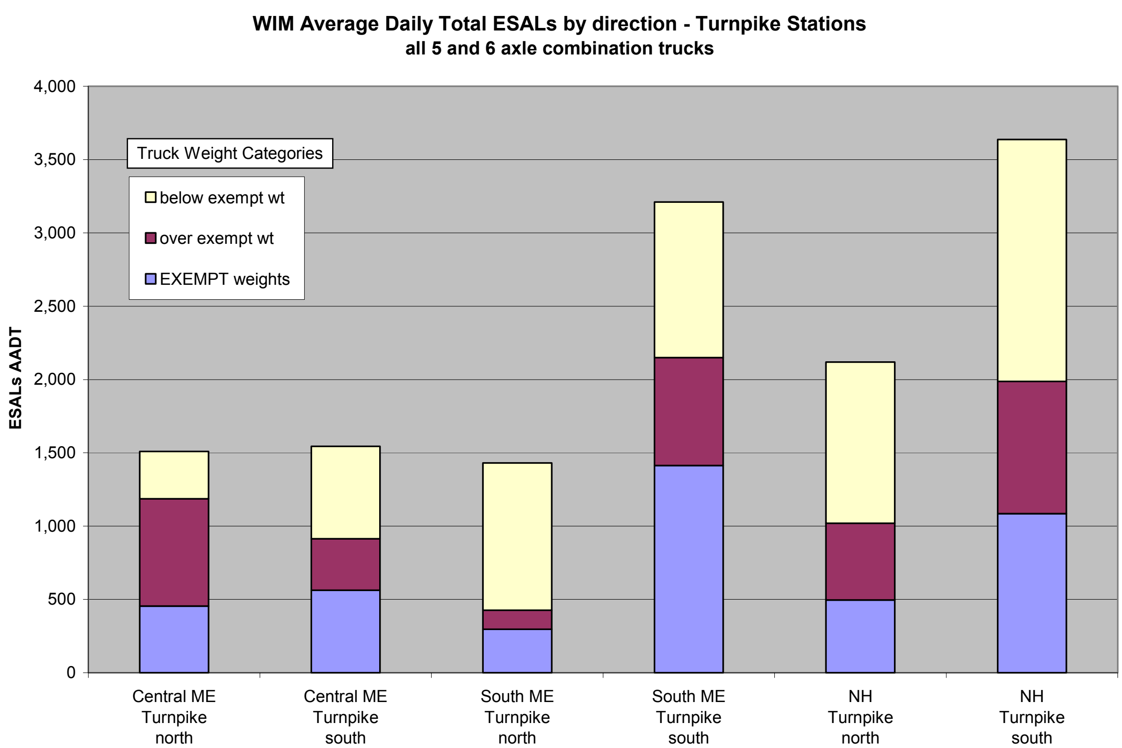


Exhibit A-6: Turnpike WIM Stations – ADTT by # Axles

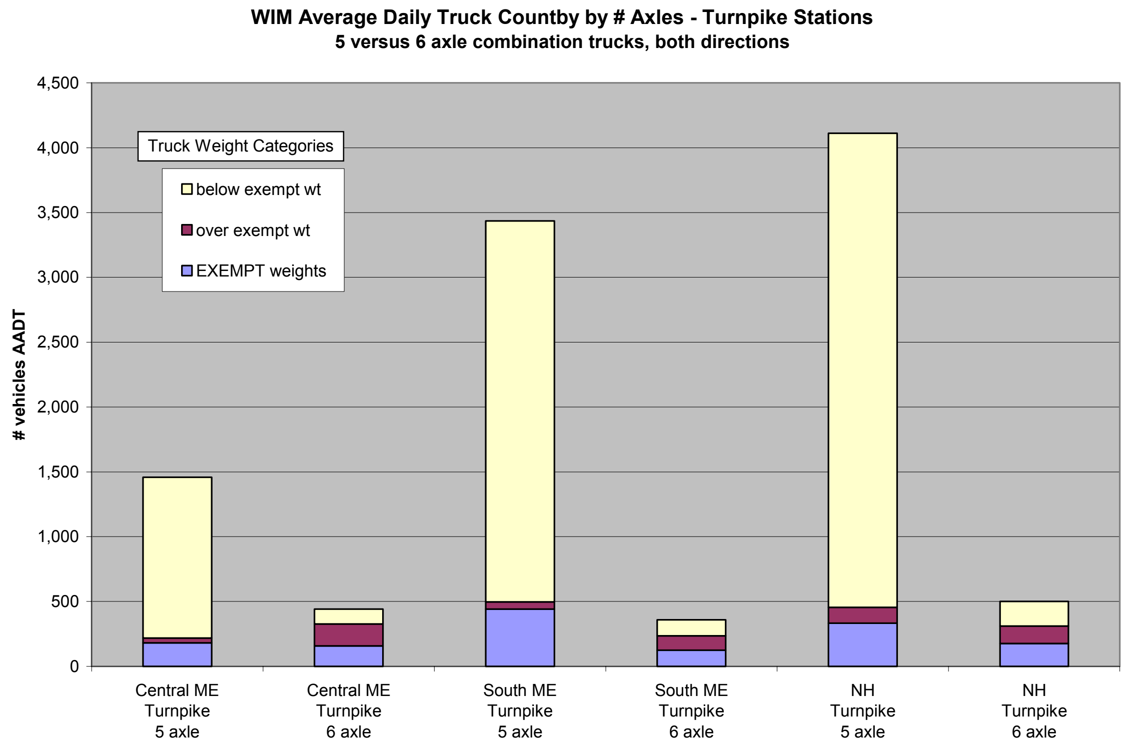
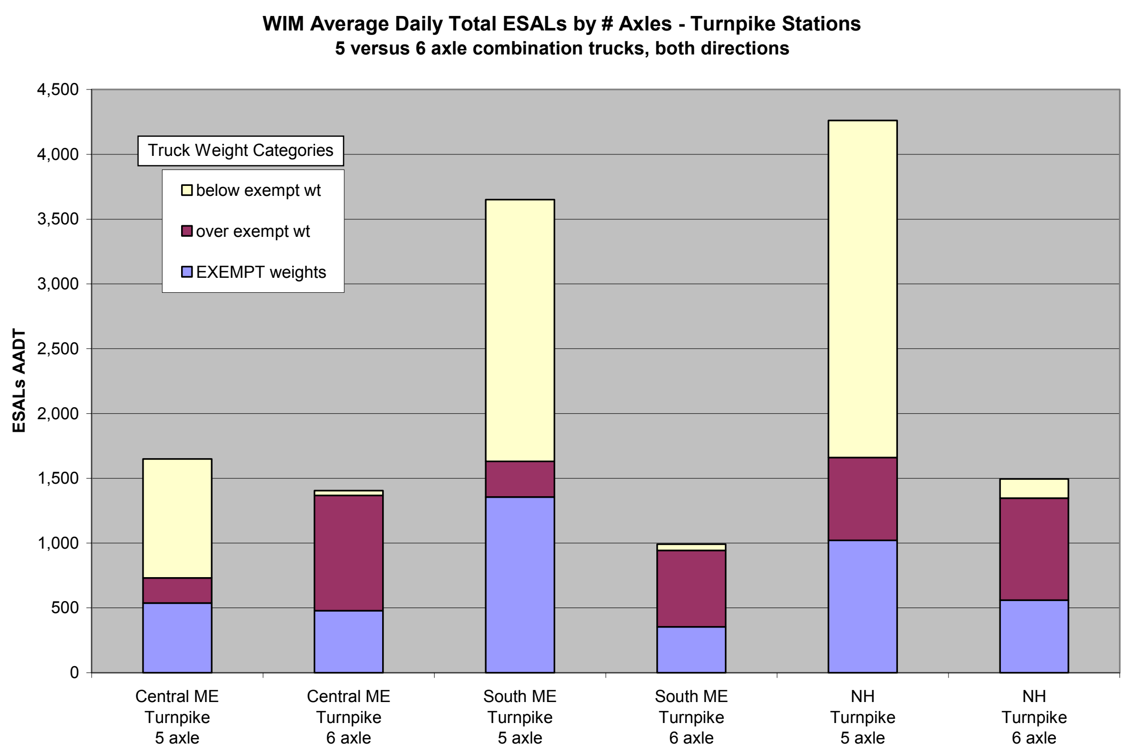


Exhibit A-7: Turnpike WIM Stations – ESALs by # Axles



Detailed Average Annual Traffic by Station

On the following pages, detailed directional statistics are presented for WIM stations on the Turnpike. The statistics are broken down by number of axles: either 5 or 6 axle.

The tables represent **average annual daily values** for all figures. Within each direction/axle grouping, rows of data are presented for all vehicles in the axle/weight category indicated by the row and column, consisting of *total average annual daily values for*:

1. vehicle count (i.e. average daily number of 5 axle or 6 axle combination trucks);
2. ESALs; and,
3. weight (the sum of the loaded weights of the vehicles, in **millions of pounds**).

The **weight category** columns divide the data by loaded GVW category:

- *below exempt wt* – loaded GVW below exempt weights;
- *exempt weights* – 5 axle with loaded GVW between 80,000 and 88,001 lbs., or 6 axle with loaded GVW between 80,000 and 100,001 lbs.;
- *above exempt wt* – loaded GVW above exempt weights.

NOTE that **zero values** in the vehicle count rows are often a result of rounding daily values that are less than one vehicle, on average, per day in that weight/axle category.

Exhibit A-8: Central ME Turnpike WIMS Average Annual Traffic

Central ME Turnpike		weight category			Total
number of axles		below exempt wt	exempt	over exempt wt	
5 axle	AADT	1,241	180	38	1,460
	ESALs	917	538	194	1,649
	million lbs	62	15	4	81
6 axle	AADT	115	157	170	442
	ESALs	36	478	890	1,405
	million lbs	5	15	18	38
station TOTAL	**AADT**	1,356	**337**	208	**1,901**
	ESALs	953	**1,016**	1,084	**3,053**
	million lbs	67	**30**	22	**118**
PERCENT of total	**AADT**	64%	**22%**	14%	
	ESALs	16%	**37%**	48%	
	million lbs	45%	**31%**	24%	

Exhibit A-9: South ME Turnpike WIMS Average Annual Traffic

South ME Turnpike		weight category			Total
number of axles		below exempt wt	exempt	over exempt wt	
5 axle	AADT	2,939	441	56	3,436
	ESALs	2,019	1,356	274	3,650
	million lbs	147	37	5	189
6 axle	AADT	122	125	111	358
	ESALs	47	354	590	991
	million lbs	6	11	12	29
station TOTAL	**AADT**	3,061	**566**	167	**3,794**
	ESALs	2,066	**1,711**	864	**4,641**
	million lbs	153	**48**	17	**218**
PERCENT of total	**AADT**	64%	**22%**	14%	
	ESALs	16%	**37%**	48%	
	million lbs	45%	**31%**	24%	

Exhibit A-10: NH Turnpike WIMS Avg. Annual Traffic

NH Turnpike		weight category			Total
number of axles		below exempt wt	exempt	over exempt wt	
5 axle	AADT	3,657	333	122	4,112
	ESALs	2,601	1,021	639	4,261
	million lbs	174	28	12	214
6 axle	AADT	190	176	135	500
	ESALs	149	559	788	1,495
	million lbs	10	16	15	40
station TOTAL	**AADT**	3,847	**509**	257	**4,612**
	ESALs	2,750	**1,580**	1,427	**5,757**
	million lbs	184	**44**	26	**254**
PERCENT of total	**AADT**	64%	**22%**	14%	
	ESALs	16%	**37%**	48%	
	million lbs	45%	**31%**	24%	

Observations Arising From Review of the WIM Data:

1. The two Maine Turnpike stations have the highest traffic volumes among all the Maine WIM stations examined (the remainder are off the Turnpike). The New Hampshire Turnpike station has the highest 5 and 6 axle truck volumes of all the stations examined.

2. Trucks operating in the exempt weight ranges account for about one-third the cumulative ESAL calculations. The ESAL estimates from WIM stations at the south end of the turnpike have are dominated by a southerly directional flow for all 5 and 6 axle truck traffic, including higher-weight traffic.

3. A high proportion of the vehicles recorded in exempt weight ranges by Turnpike WIM stations are 5 axle trucks. The total ESAL estimates for vehicles at and above exempt weight limits, is roughly equal for 5 axle vehicles and for 6 axle vehicles. However, a significant proportion of the cumulative ESAL estimates for six axle vehicles result from vehicles traveling at weights above 100,000 pounds.

4. It is assumed that vehicles above exempt weights (above 88,001 pounds for a 5 axle truck, or above 100,001 pounds for a six axle truck, both indicated as 'over exempt wt' in the Exhibits), are traveling under special permits and would continue on these same routes even if general weight laws changed. However, the implications of this assumption should be carefully considered, since these vehicles account for very high proportions of the ESAL loads – often exceeding the total ESAL loads of exempt vehicles (despite significantly fewer vehicles).

5. The direction and volume of flows at specific points (the WIMS stations) can only be interpolated to impacts at other points in the network by matching these flows to overall commodity flows and their ultimate origins and destinations. This will be the next step for this analysis.

Study of Impacts Caused by Exempting the Maine Turnpike and New Hampshire Turnpike from Federal Truck Weight Limits

Appendix B: Summary of Carrier/ Shipper Telephone Interviews

Interview Population

The names of companies to be interviewed came from several sources. The Maine Motor Transport Association (MMTA) provided a contact list of heavy haul companies. Approximately 20 MMTA member companies were contacted, yielding 15 completed interviews with 15 heavy haul companies. Companies in New Hampshire were identified through several sources. A database of manufacturers' was sorted by companies located in the Southeastern area of New Hampshire and by commodity types: lumber or wood products; clay, concrete, glass, or stone; and petroleum. Approximately one third (20) of these companies were contacted, but only one company was suitable. In contacting these companies, a representative from the Associated General Contractors identified other companies as well as the New Hampshire Motor Truck Association. Contacts from the Association graciously suggested additional names – providing nearly half of the companies subsequently interviewed. Of 40 New Hampshire companies contacted, 9 usable interviews. The summary results are based on the following companies:

Having a primary terminal in Maine:

- Cianbro Corporation
- Cousineau, Inc.
- Currier Trucking Corp.
- Dead River Transport
- Dysart's Transportation, Inc.
- Genest Concrete Works, Inc.
- H. O. Bouchard, Inc.
- Irving Oil Corporation
- K-B Corp.
- N. C. Hunt, Inc.
- Orland Dwelly & Sons, Inc.
- Richard Carrier Trucking, Inc.
- Isaacson Lumber Co.
- Paulson Brothers Transportation, Inc.
- J&S Oil Co., Inc.

Having a terminal in New Hampshire:

- Pike Industries
- Plourde Sand & Gravel Co., Inc.
- Johnson & Dix Fuel Corp.
- Skip McKean Petroleum Products
- Triple L Lumber
- Construction Aggregate, Inc.
- WeLog, Inc.
- Abenaqui Carriers and Heavy Hauling
- Aranco Oil

Interview Protocol

The interviews for this study were conducted over two time periods. The first series of interviews were conducted between October 11 and November 12, 2002. A second group of interviews were conducted between June 30 and July 11, 2003. The interview protocol was pre-tested to determine if the line of questioning produced usable data. Results from the first series of completed surveys prompted several additional questions to be added to the second round of interviews. The new questions asked for details about vehicle configuration, e.g., number of axles, whether the carriers used tridem-axle trailer configurations and whether these trailers had lift axles; if the lift axles were original equipment or retrofitted; and what type of suspension systems where used. Several other questions were added regarding the average wage of a driver and the expected cost of a new five-axle tractor-semi-trailer. A copy of the final survey instrument is included at the end of this summary.

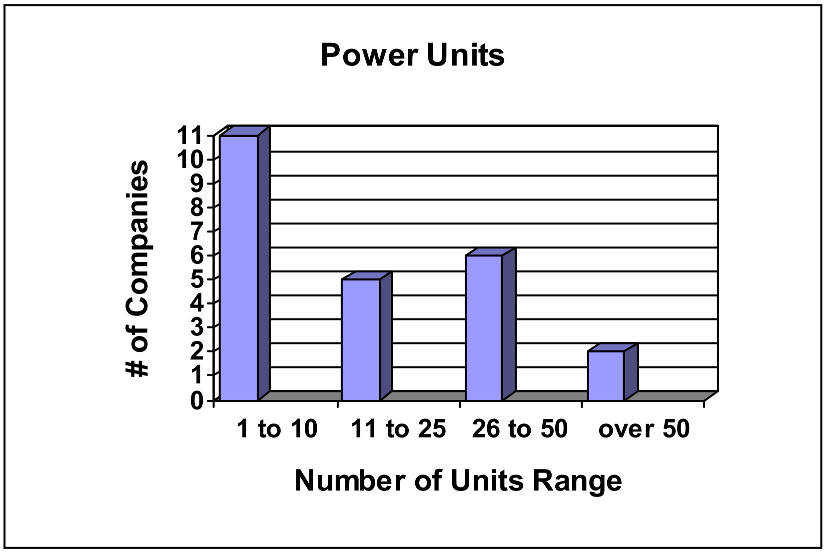
Survey Response Summary

Contact at Organizations Interviewed: The individuals interviewed knew the operations and routing used by the company for its heavy load movements. Among the titles of the individuals interviewed were:

- Dispatcher – Transportation Services / Heavy Haul Division
- Traffic Manager
- Manager – Construction Division
- Fleet Manager/Transportation Division Manager
- Operations Manager
- General Manager
- Transportation Manager
- President/Owner

Location: A majority of companies interviewed in Maine were located off Route 2, near Augusta, Rockland, Hampden, Hermon, Bangor, Pittsfield, Skowhegan, and Bucksport. Two companies were located in the southern part of the state in Sandford and Jefferson. As can be expected, these companies use the Maine and New Hampshire Turnpikes extensively for movements in the southern part of Maine and to the south and west.

Companies interviewed in New Hampshire are primarily located in the southern part of the state, e.g., North Hampton, Suncook, Belmont, Henniker, and Concord. Two other companies interviewed are from the northern part of the state, Colebrook, and from the western part, Lebanon. While the companies in the southern part of the state have greater access to the New Hampshire and Maine Turnpikes, even the most northerly located company uses both of these turnpikes. Many of the companies are located near an interstate route.



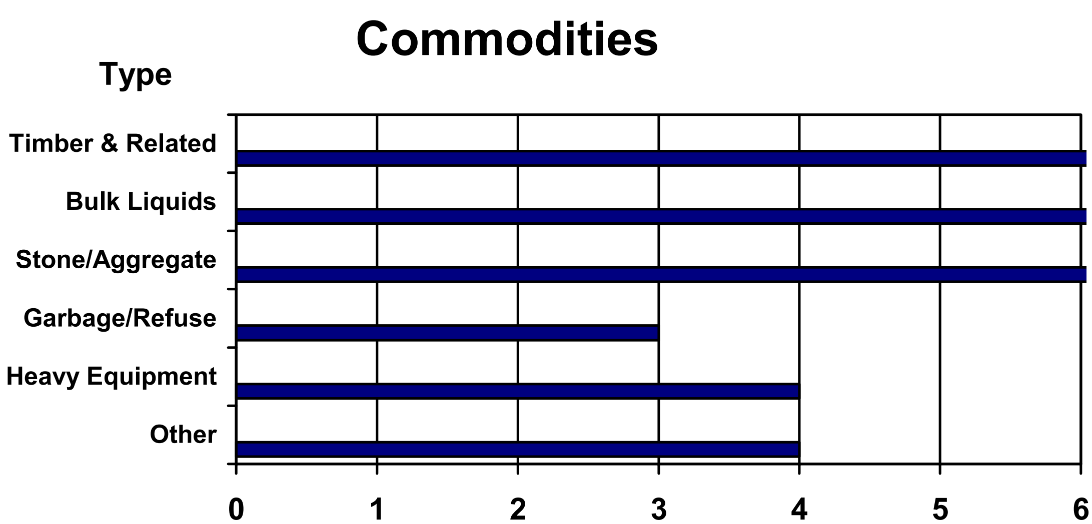
Power Units: Companies interviewed had a variety of power units. Most units were owned, however one company hired over half of its units. The companies operate five- and six-axle vehicles, used for in-state deliveries and over-the-road hauling. One company mentioned it used its six-axle vehicles for 80,000 lbs GVW loads as needed/available. The chart above provides a distribution of carrier size based on power units.

Type of Carrier: Out of 24 companies, 8 described their operation as "for hire." The remaining 16 hauled their own products and considered their transportation operations as private carriage. Fourteen of the companies interviewed considered their operation a "truckload" carrier. Two carriers described themselves as providing "specialized" services, requiring moves to be permitted, which they receive for the size as well as the weight of the loads.

While the companies use the Maine and New Hampshire Turnpikes, they also use state routes that connect with routes elsewhere in Maine or in New Hampshire and Vermont where they cans haul their heavy loads.

Competition: For companies hauling wood products (e.g., bark, logs, wood chips) competition comes from within Maine and New Hampshire, as well as other New England states and Canada. For companies hauling bulk liquids, e.g., petroleum, the competition is mainly considered as coming from within New England. Larger petroleum companies have "sister companies" in Canada, precluding competition between companies of the same parent. Companies hauling stone and aggregate or asphalt reported that their primary competition comes from within the state in which they are located. One company carrying cement saw competition from both within the state and from other New England states.

Primary Commodities: The primary commodities hauled by the companies interviewed are timber and related products e.g., unfinished – bark, logs, wood chips, and finished – lumber and other products; bulk liquids e.g., chemicals, gasoline, and fuel oils; stone and aggregate; garbage/refuse, including biomass; heavy equipment, e.g., construction equipment; and other commodities described as concrete and landscaping block, coal, salt, cement, asphalt and some mixed consumer products.



Note: Chart reflects multiple answers from respondents -- some companies haul more than one commodity.

Geographic Area: 18 of 24 companies interviewed operate within the New England region – describing their operation as regional or interstate New England. Four companies operated over-the-road divisions in the eastern U. S., which haul 80,000 lbs. None of the companies interviewed considered their operations international, however at least two companies reported having primary destinations in Quebec. No company described itself as local.

Origins and Destinations and Primary Routes: Many of the companies interviewed were strategically located near major arterials in Maine and New Hampshire including Turnpike and/or Interstate Highways. Primary routes for hauling petroleum products include origins at marine terminals in Searsport, Bucksport, Portland, and Portsmouth and destinations throughout Maine and New England, e.g., Houlton, Bangor, Wiscasset, Brunswick, and into New Hampshire, Vermont, and south. Timber-related movements have origins and destinations at major facilities such as Calais, Jay, Millinocket, Jackman, and Skowhegan. One company hauling biomass/refuse has a major contract for movements between East Millinocket via Rochester, NH, and Boston. Other hauling of biomass/refuse reported by respondents is between Waite and Ashland, Bath and Brunswick, and Biddeford and Augusta. Companies hauling commodities such as finished wood products, concrete block, chemicals, cement, and aggregate described primary movements, from mid-state north toward Presque Isle, mid-state Bangor or Pittsfield and west to New Hampshire, Vermont, and New York, and a coastal route east.

The Maine Turnpike is a primary route for through movements with origins/destinations south of Maine. Routes 1 and 201 are also a primary routing used between Portland and Augusta. A number of operators cited the lost time involved with continuing on the Maine Turnpike north of Portland. In addition, movements going east to Rockland and Thomaston require using Route 1 rather than the Maine Turnpike.

(Additional routing details are provided in a table at the end of this document)

A majority of the companies that were interviewed in New Hampshire operate or are located in the southern part of the state. Petroleum hauling companies interviewed are located in Concord, Henniker, and Lebanon. In addition to their terminal locations, origins in Massachusetts (Boston) had destinations in Lebanon and Concord, using I-93 and Route 3 and Route 4. Other movements identified were from Portsmouth to Henniker via the New Hampshire Turnpike, Routes 101, 3, and 4. Portsmouth to Newport follows the Turnpike, Routes 4 or 101, Route 4, 9/202, 114 and 103. Trips from Concord to Portland primarily use Route 101 and the New Hampshire and Maine Turnpikes. Additional moves are near Lake Winnipesaukee – Portsmouth to Wolfeboro, via Routes 16, 11, and 28. Other destinations near the lake require the use of Routes 9, 11, and 25.

Overall, the respondents reported significant north-south movements with relatively few routing choices. As one company representative said, "Route 3 is just about the only legal route there is for north and south movements for heavy loads." Routes 101, 4, 202, and 2 were the most commonly mentioned east-west routes. A number of respondents also reported that they hauled heavy loads on small segments of the Interstate system that conveniently connected some of these routes.

In addition to using the Interstates as connectors between states routes, many of the companies interviewed traveled on significant portions of the Interstate System in New Hampshire. Routes I-89 and I-93 were the most often cited. Many of the respondents mentioned that the fines for overweight vehicles on the interstate system are relatively small and the trade-off for time savings and vastly improved safety was worth the risk of being fined. One company representative mentioned that trucks carrying up to 100,000 lbs gross vehicle weight (GVW) would continue to use these interstate highways because the enforcement and fines were not a sufficient deterrent. Another discussed that the drivers knew when the weigh stations were open on the interstates and used state routes in order to bypass them. One respondent mentioned that every six-axle tractor-semi-trailer on the interstate system was carrying heavy loads and therefore illegal. Several respondents discussed that the competition, particularly from out-of-state, will continue to use the interstates and if their own companies did not also use these routes, they would incur substantial economic penalties.

On the whole there was considerable consternation regarding the inability to legally use the interstate routes in New Hampshire as well as parts of I-95 in Maine. The primary reasoning from the respondents was that "the interstates were built to carry 100,000 lb vehicles." Several mentioned that the system was originally designed as the national military network and therefore was also equipped to carry their heavy loads. A number of others interviewed could not understand the reasoning of forcing heavy vehicles onto state routes where they were required to go through population centers, deal with congestion and tourists, and in general, create increased opportunity for a major catastrophe whether it would be loss of life or contamination of a waterway/seashore. One respondent was convinced that it would take such a major event to begin the process of change.

The routes discussed were mentioned again and again by the various companies interviewed. While the number of companies interviewed was relatively small, the convergence of the routing decisions shows that even a small representation of haulers may be providing a picture of the routes upon which a high percentage of heavy loads are being transported. Additional information on the origins and destinations and routing decisions are included at the end of this summary.

<u>Avoided Routes</u>: Ten of the 12 respondents in the second round of surveys reported that their drivers did not need to avoid specific routes due to bridge postings or clearance restrictions. One respondent noted that in the spring or winter some routes might be temporarily posted, but that such postings caused no problems. Another respondent noted that there are height restrictions in the new tunnels in the Boston area. This respondent said he knows 5 drivers who have incorrectly received $500 over-height dimension tickets for traveling through these tunnels with vehicles less than the specified height. This company plans to avoid the new Boston tunnels until these sensors are better calibrated.

The heavy equipment hauler noted that they could not haul over-dimension vehicles on the Interstate System (permitted vehicles) from Friday noon until Monday morning. This respondent thought it made no sense to force the large over-dimension traffic on small roads going through towns and population centers. This same respondent noted that overweight vehicles (greater than 80,000 lbs GVW) could not use the bridge at Brattleboro until the construction is complete.

Every one of the respondents at some point during the interview mentioned that they could not travel on the Interstates, except the Maine and New Hampshire Turnpikes.

Shortest Distance vs. Circuitous Routing: Most respondents said they route their movements to obtain the shortest distance between pick-up and delivery. Yet, they also indicated that routing depended on a number of variables that could influence a driver to take either the shortest distance or the route that takes the least amount of time. Most respondents said they considered both aspects distance and time in planning their routes. Of concern was traffic and congestion especially during rush hours near business centers and particularly tourist sightseeing during the summer and fall months. Respondents were also very aware of the safety aspects relating to selecting routes. They want their drivers to be traveling on the safest routes. Respondents mentioned road construction as another reason for changing the vehicle route. In general, the companies want their shipments to be delivered safely in the least amount of time, which may involve a circuitous route rather than a direct route.

The weight restrictions on interstates were the most frequent reason for companies using more circuitous routes. Nearly every company wanted relief from what they considered was a major cause of wasted time and money and lack of efficiency.

One respondent couldn't understand why the political process had be engaged to allow the Maine Turnpike to carry 100,000 lbs GVW. It was his belief that when petitions for use by heavy hauling companies on other parts of the interstate were presented, they were turned down flat because "such exemptions are not allowed by the federal government." In addition, several respondents were puzzled over the DOT's actions to build a third bridge in Augusta. The bridge is to mitigate congestion, yet the trucking operators thought there could be a great deal of congestion relief (perhaps eliminating the need for a third bridge) if the heavy trucks could use the Interstate through Augusta.

Driver Challenges: The most often cited challenges for drivers were the requirement for movements of 100,000 lbs GVW vehicles on narrow two-lane, two-way roads and through small towns and population centers. Rotaries and stop-and-go traffic, e.g., congestion, school busses, were particularly troublesome for drivers. High crowned roads present further challenges for drivers, as the vehicles tend to rock back and forth, e.g., Route 11, Brownsville to Millinocket.

Augusta was cited as a particularly difficult area for drivers. After exiting from the Maine Turnpike, the various rotaries that the heavy vehicles must negotiate were seen as very dangerous and unnecessary considering that the interstate continues north and the heavy loads could be using these highways.

Companies that operate vehicles on Route 1 in Maine cited the Freeport, Rockland, and Camden areas as major problem spots due to tourists and the resulting congestion. One respondent said, "The Route 1 corridor is a nightmare." Petroleum haulers were particularly concerned about the frequent trips of these hazardous materials through such congested areas (automobile traffic as well as commercial establishments.)

Southeastern New Hampshire (greater population) and the area around Lake Winnipesaukee (tourists) were cited as problem spots for that state.

Route 201 from Augusta to Fairfield is seen as a problem stretch of roadway – it takes longer and is considered dangerous. This stretch of Route 201 directly parallels the interstate. Many of the drivers compare this roadway to the well-maintained, free-from-population-centers interstate and know the road they must travel poses additional safety hazards.

Drivers find the Bangor area a challenge, considering that the vehicles must travel through the city to follow Route 2.

Route 69 in winter is a problem and routing is modified to bypass this stretch of roadway.

Route 2A is particularly difficult for drivers in the spring due to potholes and deteriorating pavement. One respondent said his company reroutes traffic in the spring to Route 1 to avoid 20 mile per hour travel over rough pavement.

Performance of Six-axle Vehicles: None of the respondents were aware of any complaints with the performance or operation of six-axle vehicles greater than 80,000 lbs GVW. The general comment was that overall there are no more complaints about six-axle vehicles than five-axle vehicles. A number of the respondents said the six-axle vehicles had better braking capabilities, more stability, and generally had greater power for keeping up to speed in the traffic flow. One responder said, "We love them; you can never have too much brakes." Another said his drivers prefer the six-axle combinations because they "hold up better" and "are safer." Another respondent said they are no different; if you have a good driver who handles the vehicle well, both are the same.

Importance of Weight Limit Exemption: All respondents clearly said the weight limit exemption is essential/very important to their business. One respondent described his company's business as being centered in the northern part of the state, not near any of the interstate system, so exemptions of this kind are not as critical. However when this company provides services in the lower part of the state, use of the Maine and New Hampshire Turnpikes is essential for that portion of business.

Comments from a number of the respondents focused on the belief that the Turnpikes are the safest roadways to carry petroleum products. The highways are away from population concentrations, the roads are multi-lane, well maintained, and enable overall less time on the roadway for the transportation of dangerous commodities.

A company hauling timber products reported the exemption on the Maine and New Hampshire Turnpikes saves the company a great deal of money. This respondent observed that the Turnpike and interstate highways were "built better" and by allowing heavy loads on the Turnpike and interstates, less damage would be done to the many state routes. His thought was that everyone wins, the interstates are easier to maintain and weigh-in-motion stations could be set up on these highways because they would be the routing of choice for all heavy haulers.

If heavy loads were not allowed on the Maine and New Hampshire Turnpikes, such loads would be routed on the adjacent state routes. Again, safety was cited as a significant concern. Drivers do not want to travel on the state routes when there is a potentially safer alternative, the interstate.

Several respondents discussed the essential nature of the exemption in economic and marketing terms. Using the Maine and New Hampshire Turnpikes for heavy loads allows these carriers to compete more effectively through lower cost service. In particular, the lower cost of hauling on the turnpikes is important for less expensive commodities like wood chips and bark. One respondent noted that when hauling such low margin commodities, this exemption is critical for sustaining the business.

Use of the turnpikes provides benefits to the carriers through less costly maintenance of the vehicles. A number of the respondents considered the smoother turnpikes an opportunity for less vehicle damage and fewer repairs.

Every respondent used the question about the importance of the exemption on the Maine and New Hampshire Turnpikes to discuss the need for a similar weight limit exemption to be applied to all of the interstate. The general comment was that heavy and large trucks should travel on highways best equipped to handle them, that is the interstates.

<u>Effect of Discontinuing the Exemption</u>: Without exception, all companies interviewed considered discontinuation of the exemption a seriously negative impact on their business. The following table shows what effect this discontinuation would have.

Effect on Operation	Number of Responses
Add new equipment	8
Additional drivers/shifts	11
Reroute existing equipment	17
Other (Hire trucking services)	1

Note multiple answers from respondents -- more than one impact could result.

One company with ten heavy haul vehicles estimated that it would have to expand its fleet by one-third, which would also require one-third more drivers and total at least $300,000 to $400,000 additional cost per year. Similarly another respondent remarked that this discontinuance would increase the truck traffic by about one-third and promote a greater deterioration of the roadways due to increased numbers of trucks and potentially more damaging five-axle configurations.

Several companies consider their margins so low that discontinuing the exemptions might cause them to review the viability of their business. Such comments came primarily from refuse/biomass and timber products haulers.

While not all respondents discussed the issue of the substantial investment in six-axle vehicles, those that did remarked that a discontinuance of the exemption would be a tremendous waste of capital.

Of the respondents that determined their company would re-route the existing equipment, Routes 1, 201, and 202 were cited as being the alternative routes of choice in Maine, as well as Route 4 into New Hampshire.

In general the opinion of the respondents was that discontinuing the exemption would cost their companies substantially more money, would significantly increase transport time, and would dramatically increase safety risks. All respondents expressed a desire to see the weight limit exemption applied to all of the interstates in Maine. Several of the companies remarked that such a positive change would allow their businesses to grow. One respondent thought that if there were an attempt to rescind the exemption, a serious movement would arise to challenge the rescission. Respondents were very concerned about this topic and many spoke with a great depth of knowledge on the issues.

Additional Questions in the Second Round of Interviews (based on 3 companies located in Maine and 9 companies in New Hampshire)

Record-Keeping Exemption – 100 Air-miles: Companies varied on their use of CFR 391, which exempts a carrier for operations within 100 air-miles from hours of service, driver qualification files, and other vehicle maintenance record keeping.

Four companies did not use the exemption, preferring to keep logs and other records, and as one company reported, the driver logs were used for paying wages. Three companies did use the exemption and reported that their facility was relatively in the middle of their service area so that they only had less than 100-mile trips. Four companies used the exemption for some of their operations. One company reported that most of their operations did not use the exemption, however a few part-time drivers were making use of the exemption. For this sample, there does not appear to be any strong correlation between the geographic operation of the company and the use of the exemption. . Additionally, there was no one particular commodity that was carried by companies using this exemption.

CFR 391 Exemption	Number
Do not use exemption	4
Use exemption	3
Use exemption for part of operations	4

Equipment: Companies located in Maine operated on average about 9 TST combinations (all TSTs, not only those located in the company's primary terminal.) The companies in New Hampshire averaged about 15 TST combinations in their fleets. Combining both states, the fleets averaged about 13 TST combinations. The range of TST combinations operated by companies in New Hampshire was 1 to 45 vehicles.

About 40 percent of the TST combinations operated by the companies have 5 axles. The remaining approximately 60 percent are 6-axle combinations. A few respondents (for example the heavy equipment hauler) reported that their companies also have a few 4-axle trailers.

About 90 percent of the 5-axle vehicles are registered to haul 88,000 lbs. All of the six-axle TST combinations are registered to haul up to 98,000 to 100,000 lbs. All but one of these trailers had a tridem axle. In addition, respondents reported that all but a very few of the tridem axle trailers were original equipment with the remaining few being retrofitted to the trailer at some point after the initial purchase.

Respondents in Maine reported that one company had tridem axle trailers with spring suspension, one company had trailers with air ride suspension, and one company had a combination of both spring and air ride suspension on its tridem axle trailers. Respondents from companies in New Hampshire reported: 4 air ride, 3 having both air ride and spring, and 2 did not know the type of suspension on their tridem axle trailers. The following table summarizes the responses.

Type of Suspension	**Maine**	**New Hampshire**
Spring	1	
Air Ride	1	4
Both Spring and Air Ride	1	3
Do not know		2

Respondents estimated the cost of a new 5-axle tractor-semi-trailer combination would average about $160,000. Estimates ranged from about $105,000 to $190,000.

<u>Assuring Vehicle Loads Do Not Exceed Legal Limits</u>: For the most part every company interviewed has some strategy to assure that their vehicle loads do not exceed the legal limit. The petroleum product haulers all reported that they know the weight of the product and the capacity (volume) of each of their vehicle configurations, which assures a legal limit. Like the petroleum product haulers, the cement and asphalt haulers interviewed also know the amount of product their vehicles carry and its weight. The stone and aggregate haulers reported that they have scales in their yards.

One dispatcher that was interviewed had the responsibility for checking the vehicle weights. The vehicles do not go out of the yard prior to weighing and assuring a legal load. Some of the vehicles operated by one of the forest product haulers vehicles have on-board scales. (This was the only company with such equipment.) This company also pays the drivers by the hour, so there is no advantage to overload. A petroleum products hauler noted that if a driver gets fined for carrying an overweight load, the driver must pay the fine. The heavy equipment hauler stated that they know the weight of the equipment and determine their gross vehicle weight based on these facts. Only one of the companies interviewed stated that they rely on the experience of the driver and that there are a lot of available scales.

Average Driver Wage: Driver wages varied depending on several factors: the type of vehicle, the experience of the driver, and the hours/days worked per week. Sample responses included the following:

- $12 - $20 per hour depending on the type of vehicle
- $15 - $20 per hour
- $650 - $850 per week for a good driver with either a 56 or 60 hour work week
- $40,000 - $50,000 per year with either a 56 or 60 hour work week
- $27,000 - $30,000 per year, 5 days per week – home every night
- $14 per hour

Including all the responses produces an average wage of $15 per hour wage. This represents 11 companies; one interviewee did not provide an estimate of wages paid to drivers in New Hampshire.

The average wage of a driver for the three companies interviewed in Maine is $14 per hour. As information, these three companies hauled forest products, cement and stone/aggregate, and petroleum products. There was little variation in the reported estimated wages from each of these three companies.

For the companies interviewed in New Hampshire, the wage calculated from averaging all 8 responses is $15.30 per hour. The three petroleum products haulers and the heavy equipment hauler estimated from $1 to $2.50 higher per hour than the average wage paid, e.g., $16 - $17.50 per hour average. Several of the asphalt and stone/aggregate and forest product haulers paid $1 - $2 dollars less than the average for all companies interviewed in New Hampshire, e.g. $13 - $14 per hour.

Monetary Value of the Exemption: Eight of the respondents, 75 percent, said that they were not aware of any attempt by their companies to place a monetary value on the effect of the exemption or the loss of the exemption for their vehicles of up to 100,000 lbs GVW traveling on the Maine and New Hampshire Turnpikes. One of these respondents from Maine noted that it would take a longer time, increase the danger or risk of a major incident, and produce a loss of 10 to 20 percent of each load without the exemption. Additionally, benefits for his company include a decrease in the cost of raw materials.

Three respondents did a quick estimate of impact of the exemption during the interview. One petroleum products hauler simply stated that with out the exemption, the company would take a 20 percent hit on its loads. In addition to more trips required, there would be an increase in cost for maintenance of the equipment. Another respondent determined the impact for his company would be at least $1.6 million increase if the exemption were no longer in effect. The third respondent determined that without the exemption, his company would have additional costs of at least $500,000. This respondent noted that such a prospect was very discouraging and would tempt him to close his business.

Two companies had made some effort to determine costs associated with the exemption. One company had calculated that it would have to pay $1,600 to $1,800 per month additional in tolls. One other respondent reported that four years ago the company made some calculations estimating the value of benefits for the exemption. Today this could be over $2 million savings based on the exemption.

Importance of Weight Limit Exemption: Seventy-five percent of the respondents clearly said the weight limit exemption is essential/very important to their business. All the companies interviewed from Maine considered the exemption to the weight limits on the Maine and New Hampshire Turnpikes to be of the utmost importance. Five of the companies in New Hampshire also considered the exemption essential. Five others considered the exemption less than essential. For these companies, the degree of importance seemed to be directly related to the amount of use the company has on the Maine and New Hampshire Turnpikes. One respondent noted that because his company did not use the Turnpikes very often, he rated the exemption as not very important. However, this same respondent gave a second rating, he also noted that when the company uses these Turnpikes, they are essential to their business.

The following table shows the distribution of importance ranking by the respondents.

Importance of Exemption	Number of Responses
Essential/Very Important	8
Important	2
Somewhat Important	1
Not Very Important	2

Note one respondent provided two answers as described in the narrative.

A number of comments from the respondents are listed below. They detail some of the respondent's thinking on this subject.

- The exemption is important for the cost effectiveness of the fleet as well as for the raw materials coming into our facility.
- Safety is our biggest concern. The interstate, including the Maine and New Hampshire Turnpikes are the safest roads for heavy vehicle operations.
- Being able to carry 20,000 lbs more per load is critical for the business.
- The exemption allows the company to save time, save labor dollars and wear and tear on the equipment. On the routes taken, using an interstate could reduce trip time by one half.
- The time-delivery ratio is critical. Now with the driver hours effectively shortened, time waiting in line at terminals may present a problem coupled with longer transit times if the Turnpikes can't be used. The drivers may not get back before the shift ends.
- I wouldn't have a business if I couldn't go 100,000 lbs.

- The exemption decreases the risk of exposure to hazardous materials, such as gasoline, for high population areas and sensitive shore and waterways.
- The exemption allows time and cost savings, added efficiency of drivers, and safety – all beneficial.

Effect of Discontinuing the Exemption: Similarly the effect of discontinuing the exemption is dramatic. Without exception, all 12 companies interviewed considered discontinuation of the exemption as a negative impact on their business. The following table shows what effect this discontinuation would have.

Effect on Operation	Number of Responses
Add new equipment	4
Additional drivers/shifts	5
Reroute existing equipment	10
Other (Hire trucking services)	0

Note multiple answers from respondents -- more than one impact could result.

For the most part companies acknowledged that they would be required to reroute their vehicles. Unfortunately this is a less than desired choice, but a number of companies understood that because of competition, they could not go back to 80,000 lb GVW loads. The most frequently mentioned routes to which traffic would be rerouted were Routes 1 (in Maine) and 3 (in New Hampshire). With the rerouting, the transit time is longer, the roads are potentially more dangerous, and service will be degraded –producing a strain on customer relationships due to less responsive service. Many of the respondents cited the added problems going through population centers – school buses, traffic congestion, pedestrians, and tourists all pose significant problems for the heavy truck operations.

One quarter of the companies interviewed responded that all three effects would be seen in their organizations should the exemption be rescinded. These companies would not only reroute to state roads, but would also add shifts to their operations and add new equipment (80,000 lb GVW vehicles which could travel on the turnpikes and interstates) in order to maintain particularly time-sensitive service to customers.

One respondent noted that unless the level of enforcement changes in New Hampshire, many truck operators would not change their routing, even if the exemption were discontinued. As stated previously, operators are willing to take the risk of traveling overloaded on the New Hampshire Turnpike and interstates and paying a relatively minimal fine.

Another company determined that the extra cost of drivers and equipment would require raising his costs to his customers. Such rate increases were considered highly detrimental to the company’s competitive stance. Furthermore, one respondent expressed concern that he would not be able to get work because of the higher cost of doing business. Lastly, one respondent stated that a discontinuance of the exemption would cause him to seriously think about closing his operation.

Wilbur Smith Associates
ENGINEERS
PLANNERS
ECONOMISTS

Date: ____/____/03

Maine Weight Exemption Study
Carrier Interview Survey

Company Name: ____

Location/Address: ____

Contact: __________________________ **Title:** ________________________

Phone: _________________________ **e-mail:** _______________________

Purpose:

1. Develop an operating profile for heavy haul industries in Maine
2. Understand operating economics for heavy haul carriers in Maine.
3. Explore routing decisions based on various weight policies that could potentially be applied to I-95 and the Maine and New Hampshire Turnpikes.

Introduction – (Assuming a direct contact at the company is listed as a contact)

1. Hello, my name is Barbara Harder, I'm a transportation consultant who is part of a team that is conducting a study for the Maine DOT regarding the impact of trucks over 80,000 pounds operating on the Turnpike. The study we're conducting was mandated by Congress in the last highway reauthorization bill as an element of the exemption from federal weight limits that Congress granted to Maine and New Hampshire. Congress will be reviewing the results of our study next year during the next reauthorization process and decide whether to continue the current exemption, extend the exemption to the entire Interstate in Maine or rescind the current exemption. The reason I am calling is that members of our project team need to understand how the current exemption affects the routes your drivers use and how you would likely react to changes in the current law. Are you the person responsible for managing equipment and routing decisions at your facility?
2.

YES.......CONTINUE: What is your title?______________________

NO.........DISCONTINUE
Who would this person be?__________________ Phone?
Title?

Background:

1. Are you a private or for-hire carrier?

a. ____ For-hire (skip to Q4) b. _____ Private

2. What is the primary business your company is engaged in?

____

3. Where does your primary competition come from within your industry (outside of Maine/New Hampshire)?

____

____

(Skip to Question 6)

Commodities / Services:

4. As a for-hire carrier, do you have primary commodities or lines of business that comprise the majority of your business? ________No (go to question 5),

________Yes; what are those primary commodities?

a. _____ Timber or Related Products b. _____ Stone or aggregate

c. _____ Garbage or refuse d. _____ Sludge

e. _____ Bulk liquids (e.g. petroleum) f. _____ Heavy Equipment

g. _____ Agriculture products g. _____ Other: ______________________

5. How would you describe your services (check all that apply)

a. ____ LTL b. ____ Truckload c. ____ Express Package

d. ____ Intermodal drayage e. ____ Specialized

f. other__________________________

Geography and Routing:

6. Do you operate more than one truck terminal in either Maine or New Hampshire?

_____ No (go to question 7) _____ Yes,

6a. At what other locations and approximately how many trucks?

Location	# of Trucks
a. ____________________	___________
b. ____________________	___________
c. ____________________	___________

7. What type of geographic area does your trucking operation cover?

a. ______ Local b. _____ Regional (intrastate Maine/Intrastate NH)

c. ______ Regional (interstate New England)

d. ______ Long haul domestic c. _____ Long haul international (what provinces?)

____

8. Do you currently operate any of your fleet under the intrastate 100 air-mile exemption from federal CFR 391? (This rule exempts carriers from hours of service, driver qualification files and other vehicle maintenance record keeping).

____ No Yes _____: How many units? __________

9/10. What are the primary origins and destinations for the commodities you haul?

Origin	**Destination**

a. ______________________________ ______________________________

Route ____

____

b. ______________________________ ______________________________

Route ____

____

c. ______________________________ ______________________________

Route ____

____

d. ______________________________ ______________________________

Route ____

____

(If I-95 or the Maine/New Hampshire Turnpikes are not mentioned above ask specifically.)

11. Do your drivers generally use routes that are either the shortest distance or those that require the least amount of time between the pick up and delivery?

_____ Shortest distance

_____ Least amount of time

12. Are you aware of any routes that are avoided due to bridge postings or weight restrictions or clearance restrictions? If so, what are those routes?

13. In using these routes are you aware of any specific challenges your drivers face on these routes, for instance areas where there are frequent accidents or near misses, routes through congested areas or places where it is difficult for a truck to maintain the flow of traffic.

____

____

____

Equipment:

14. How many power units do you operate out of your location?

a. ____ 1-10 b. ____ 11-25 c. ____ 26-50 d. _____ over 50

15. For the fleet at your location, how many units or roughly what percentage are 5-axle tractor-semi-trailer combinations? _______

15a. How many of these units are registered to haul 88,000 pounds? ___________

ADD : What is the typical cost of a new tractor-semi-trailer rig? ________________

16. For the fleet at your location, how many units or roughly what percentage are 6-axle tractor-semi-trailer combinations? _______ **If the respondent operates six-axle TST combinations:**

16a. How many of these units are registered to haul 99,000 or 100,000 pounds? _______

16b. Do the semi-trailers in your six axle vehicle fleet have tridem axles?

____No, if no skip to #17 ____Yes;

16c. Were the tridem axles on these semi-trailers purchased as original equipment, or was a third axle added as a retro-fit?

____ Original equipment ____ Retrofit

16d. Do any of the axles in the tridem axle set operate as lift axles?

______ No ______ Yes

16e. What is the typical type of suspension system on your tridem axle trailers?

____

17. Do you or any of your drivers that you are aware of have any complaints with the performance or operation of six axle vehicles greater than 80,000 pounds GVW?

____

____

18. What practices or step does your company undertake to ensure that vehicle loads do not exceed legal limits?

____

____

19. As you are likely very aware – Congress has granted an exemption to federal weight limits on the Maine and New Hampshire Turnpikes that allows a gross vehicle weight of 100,000 pounds on 6 axle configurations. How important is this exemption to your business?

a. ______ Essential/very important   b. ______ Important

c. ______ Some what important   e. ______ Not very important

Why? ____

____

20. If Congress decided to discontinue the weight exemption on the Turnpike, and reduce the weight limit on the Turnpike sections of I-95 back to 80,000 pounds, how would it affect your operation?

a. ______new equipment

b. ______additional drivers / additional shifts

c. ______ reroute existing equipment: What alternative routes would be used?

d. ______ Other: ____

____

____

____

Add 2.
What is the average wage of a truck driver in your state?

21. Has your company attempted to place a monetary value on the effect of the exemption or its loss?

______NO ______Yes, would it be able to share that impact with us

22. If Congress would decide to allow up to 100,000 GVW on the entire length of I-95 in Maine, how would that decision likely affect your business?

Routing Details gathered during the course of all interviews are provided in the table on the following pages.

Routing Details from Survey Responses

Origin	Destination	Primary Routes	Commodities	Comments
Bangor	North toward Presque Isle/Ft. Kent	Rte 2	Chemicals, fuel oils, coal, road salt, cement, aggregate	Would be nice to use I-95
Bucksport	Middle of state, Augusta, Lewiston, Waterville	Rtes 3, 139		
Portland	Lewiston	ME Turnpike		
Augusta	Fairfield	Rte 201		Major problem should use I-95
Thomaston	Massachusetts or North	Rtes 1 or 2		
Bangor	Calais	Rte 9	Bulk rolled paper	
Lincoln	Houlton	Rte 2	Petroleum products	
Portland	Bangor	ME Turnpike, North of Augusta, Rte 9	Petroleum products	
Hampden	South out of New England	ME and NH Turnpikes, interstates		80K lbs
Jackman	Poland Springs	Rte 201, ME Turnpike	Lumber, chips, bark Aggregate	Wants to use Interstate between Fairfield and Augusta
Skowhegan	Bangor	Rte 2		
Fairfield	Millinocket	Rte 2, 11		
Pittsfield	Glens Falls, NY	I-95, 495, 290, 90, 87	Construction equipment, steel, lumber forms, building materials	All are permitted, heavy and oversize
Pittsfield	Troy, NY	I-95, Rte 101, I-93, 89, Rte 4, I-87, Rte 9		
Pittsfield	Northern VT	Rte 2		
Strong	South to NH	Rte 4 to Auburn, ME Turnpike to Exit 5 Rte 11 and 202	Finished wood products Construction equipment	
Strong	North, Ashland area	Rtes 4, 2, 11		
Coastal Route Augusta	East	Rte 3		
Bangor	Lincoln	Rte2	Wood chips and logs	
Stratton	Bucksport	Rte 2		Every day run
Coming North into ME	Showhegan	NH and ME Turnpike, Rte 201 at Augusta		
Brownville	Millinocket	Rte 11		Frequent run

Origin	Destination	Primary Routes	Commodities	Comments
Operations within 100 miles of Showhegan		Rte 2		
Stillwater	Jay, Hinckley, Millinocket	Rte 2		Would love to use interstate for heavy loads
Portland	Rockland	Coastal road doesn't follow Turnpike, Rte 1	Petroleum	
Portsmouth	Portland	ME Turnpike		
Portland	Brunswick	Rte 1 through Freeport		Would like to use 295/95
Searsport	Waterville	Rtes 3, 201		
Bangor/Brewer	Houlton	Rtes 2, 2A, 9, 178		Up to 10 loads a day
Washington County (Waite)	Aroostook County (Ashland)	Rtes 1, 2, 212, 11	Biomass, Chips	
Sanford	South into Massachusetts	Rte 109, ME Turnpike Rte 236, ME Turnpike	Concrete blocks, landscape blocks	Empty uses Interstate, return loaded on alternate routes as required
Sanford	New Hampshire	Rte 202		
Sanford	North via Biddeford	Rte 111, ME Turnpike North of Augusta, Rte 9		
Sanford	Thomaston	Rte 1		
Lubec	New Hampshire	Rte 9, ME Turnpike	Bark, logs, wood chips	
Skowhegan	Jackman and into Quebec	Rte 201 into Quebec		
Jefferson	South	Rte 126, to ME Turnpike at Auburn		
Augusta	Rockland	Rte 17		
		Rte 1 and 201 absolutely vital		
Searsport/Bucksport	Houlton	Rtes 3 or 1, 1A, 2	Petroleum products	
Searsport/Bucksport	Portland	Rte 3, ME Turnpike		
Portland	Brunswick, Wiscasset	Rte 1		
Portsmouth	Conway, NH	NH Turnpike, Rte 16		
Searsport/Bucksport	Littleton, NH or Lyndonville, VT	Rtes 1A, 69 (not in winter), 2		In winter go up to Hermon and take Rte 2
East Millinocket	Rochester, NH and Boston, MA	Rte 157 to Mattawamkeag, Rtes 2, 178, 9, I-395, Rte 202, 9, to Auburn and ME Turnpike, NH Turnpike	Refuse and biomass	Not using interstate adds an hour to the time between E. Millinocket and Augusta

Origin	Destination	Primary Routes	Commodities	Comments
Boston	Hampden via Rochester NH	Interstates to NH and ME Turnpikes and Interstate to Hampden	Waste products for land fill	Backhaul, 80,000 lbs
Bath	Brunswick	Rte 1	Refuse and biomass	
Biddeford	Augusta	ME Turnpike		
Bangor	North toward Presque Isle/Ft. Kent	Rte 2	Chemicals, fuel oils, coal, road salt, cement, aggregate	Would be nice to use I-95
Bucksport	Middle of state, Augusta, Lewiston, Waterville	Rtes 3, 139		
Portland	Lewiston	ME Turnpike		
Augusta	Fairfield	Rte 201		Major problem should use I-95
Thomaston	Massachusetts or North	Rtes 1 or 2		
Bangor	Calais	Rte 9	Bulk rolled paper	
Lincoln	Houlton	Rte 2	Petroleum products	
Portland	Bangor	ME Turnpike, North of Augusta, Rte 9	Petroleum products	
Hampden	South out of New England	ME and NH Turnpikes, interstates		80K lbs
Jackman	Poland Springs	Rte 201, ME Turnpike	Lumber, chips, bark Aggregate	Wants to use Interstate between Fairfield and Augusta
Skowhegan	Bangor	Rte 2		
Fairfield	Millinocket	Rte 2, 11		
Pittsfield	Glens Falls, NY	I-95, 495, 290, 90, 87	Construction equipment, steel, lumber forms, building materials	All are permitted, heavy and oversize
Pittsfield	Troy, NY	I-95, Rte 101, I-93, 89, Rte 4, I-87, Rte 9		
Pittsfield	Northern VT	Rte 2		
Strong	South to NH	Rte 4 to Auburn, ME Turnpike to Exit 5 Rte 11 and 202	Finished wood products Construction equipment	
Strong	North, Ashland area	Rtes 4, 2, 11		
Coastal Route Augusta	East	Rte 3		
Bangor	Lincoln	Rte2	Wood chips and logs	
Stratton	Bucksport	Rte 2		Every day run
Coming North into ME	Showhegan	NH and ME Turnpike, Rte 201 at Augusta		
Brownville	Millinocket	Rte 11		Frequent run
Operations within 100 miles of Showhegan		Rte 2		
Stillwater	Jay, Hinckley, Millinocket	Rte 2		Would love to use interstate for heavy loads

Origin	Destination	Primary Routes	Commodities	Comments
Portland	Rockland	Coastal road doesn't follow Turnpike, Rte 1	Petroleum	
Portsmouth	Portland	ME Turnpike		
Portland	Brunswick	Rte 1 through Freeport		Would like to use 295/95
Searsport	Waterville	Rtes 3, 201		
Bangor/Brewer	Houlton	Rtes 2, 2A, 9, 178		Up to 10 loads a day
Washington County (Waite)	Aroostook County (Ashland)	Rtes 1, 2, 212, 11	Biomass, Chips	
Sanford	South into Massachusetts	Rte 109, ME Turnpike Rte 236, ME Turnpike	Concrete blocks, landscape blocks	Empty uses Interstate, return loaded on alternate routes as required
Sanford	New Hampshire	Rte 202		
Sanford	North via Biddeford	Rte 111, ME Turnpike North of Augusta, Rte 9		
Sanford	Thomaston	Rte 1		
Lubec	New Hampshire	Rte 9, ME Turnpike	Bark, logs, wood chips	
Skowhegan	Jackman and into Quebec	Rte 201 into Quebec		
Jefferson	South	Rte 126, to ME Turnpike at Auburn		
Augusta	Rockland	Rte 17		
		Rte 1 and 201 absolutely vital		
Searsport/Bucksport	Houlton	Rtes 3 or 1, 1A, 2	Petroleum products	
Searsport/Bucksport	Portland	Rte 3, ME Turnpike		
Portland	Brunswick, Wiscasset	Rte 1		
Portsmouth	Conway, NH	NH Turnpike, Rte 16		
Searsport/Bucksport	Littleton, NH or Lyndonville, VT	Rtes 1A, 69 (not in winter), 2		In winter go up to Hermon and take Rte 2
East Millinocket	Rochester, NH and Boston, MA	Rte 157 to Mattawamkeag, Rtes 2, 178, 9, I-395, Rte 202, 9, to Auburn and ME Turnpike, NH Turnpike	Refuse and biomass	Not using interstate adds an hour to the time between E. Millinocket and Augusta
Boston	Hampden via Rochester NH	Interstates to NH and ME Turnpikes and Interstate to Hampden	Waste products for land fill	Backhaul, 80,000 lbs
Bath	Brunswick	Rte 1	Refuse and biomass	
Biddeford	Augusta	ME Turnpike		

Origin	Destination	Primary Routes	Commodities	Comments
Livermore Falls, ME	Massachusetts	Rte 4 to exit 12 of ME Turnpike I-95/NH Turnpike, I-495	Finished lumber products, wood pallets	
Livermore Falls, ME	Millinocket, ME	Rtes 133. 202 to Augusta, I-95, Rte 150, Rte 11	Empty	Not overweight
Millinocket, ME	Livermore Falls, ME	Rte 11, Rte 150. Rte 2, Rte 133	Logs	
Thomaston, ME	Sanford, ME	Rte 1, I-95/ME Turnpike, Rte 111	Cement	
Thomaston, ME	Houlton, ME	Rte 1, 1a, to Bangor, Rte 2/2a		
Portland, ME	Hope, ME	Rte 1 to Augusta, Rte 17	Sand and gravel	
Portland, ME	Rockland & Camden, ME	Rte 1	Petroleum products	
Portland, ME	Augusta, Winslow, Waterville, & Unity	Rte 1, Rte, 201, and Rte 139 to Unity		
Portland, ME	Augusta, ME	ME Turnpike/I-95		Uses I-95 everyday
Portland, ME	Fairfield and Jackman, ME	Rte I-95, Rte 1, Rte 201, Rte 139 into Fairfield		
Searsport/Bucksport, ME	Manchester, ME	Rte 3		Daily, day of interview had two trucks coming in on Rte 3
Many routes in New Hampshire, primary Location Hooksett, Others Lebanon, Portsmouth, Gorham	To highway projects in the state	Rte 3, Rte 16 NH Turnpike, Rte 101, Rte202, Rte 4, Rte 2, Rtes 114 & 103	Asphalt Stone and gravel	Hauls on secondary routes that parallel the I-state
Suncook, Hooksett	Nashua	Rte 3	Sand and gravel	Daily run
Suncook, Hooksett	Massachusetts	Rte 3, Rte 101, I-95	Sand and gravel	
Massachusetts	Lebanon, NH	I-95, NH Turnpike, Rte 101, Rte 3	Petroleum products	
Freedom, NH	Meredith and Lebanon	Rte 25, Rte 3, Rte 104, Rte 4		
Portland, ME	Lake Winnipesaukee area	I-95 ME/NH Turnpike, Rtes 9, 16, and near lake, Rtes 109, 11, 25	Petroleum products	Uses all the routes around the lake – at least 60 loads per day
Portsmouth, NH	Henniker, NH	I-95/NH Turnpike, Rtes 4 or 101, Rtes 4/9 & 202, maybe a small portion of I-93		

Origin	Destination	Primary Routes	Commodities	Comments
Portsmouth, NH	Newport, NH	I-95/NH Turnpike, Rtes 4 or 101, Rtes 4/9 & 202, Rtes 114 & 103		
Portsmouth, NH	Wolfeboro, NH	Rtes 16, 11, 28		
Portsmouth, NH	Kittery, ME	I-95/NH/ME Turnpike	Petroleum products	Seasonal runs only
Georgetown, MA	Bridgewater, NH	I-95 including small stretch of NH Turnpike Rte 101, Rte 3, Rtes 104, 3a	Wood chips hauled north, and bark and mulch hauled south	
Boston, MA	Henniker and north	Use Rte 128 and I-495, Rte 3, Rte 202/9		Almost every day
Massachusetts	Berlin via Twin Mountains, NH	I-95, Rtes 101, Rtes 3, 115, 2, and Rte 16		
Massachusetts	Whitefield, NH and Groveton, NH	I-95, Rtes 101 & 3		
Henniker, NH	Concord, NH	Rte 202/9, Rte 202/4	Aggregate	
Henniker, NH	Bow, NH	Rte 202/9, Rte 3a		
Henniker, NH	Loudon, NH	Rte 202/9, Rte 106		
Henniker, NH	Warner, NH	Rte 202/9, Rte 103		
Henniker, NH	Keene, NH and Western MA	Rte 9, I-91	Cement	
Massachusetts	Henniker, NH	Rtes 3, 114		
Colebrook, NH	South and North into Canada	Rte 3		Only major artery north and south, and also into Canada
Henniker, NH	Maine	Rte 202/9, Rte 3, Rte 2	Logs and/or Mulch	
Massachusetts	Conway, NH and continuing to Whitefield and Canada	Rtes 3, 28, and 16 or Rtes 25, 153 and Rtes 153, 302, 3	Pulpwood and chips	
Concord, NH	Portland and Jay, ME	Rtes 4, 101, I-95 NH/ME Turnpikes, Rte 4	Logs and/or Mulch	
Portsmouth, NH	Boston, MA and Providence, RI	NH Turnpike/I-95 and Rte 128 in MA I-95 in RI	Heavy equipment	
Portsmouth, NH	Portland, ME	I-95/NH and ME Turnpikes		

Origin	Destination	Primary Routes	Commodities	Comments
North Hampton, NH	Bangor, ME	Rte 1, I-95/NH & ME Turnpikes, Rte 202	Jet fuel	
Concord, NH	Boston, MA	Rte 3, I-93	Petroleum products	
Portland, ME	Concord, NH	I-95/NH and ME Turnpikes, Rte 101, Rte 3		

Study of Impacts Caused by Exempting the Maine Turnpike and New Hampshire Turnpike from Federal Truck Weight Limits

Appendix C: Pavement Cost Impacts Development Process for the Study Network

The Maine/New Hampshire Turnpike ESAL Development Methodology

A methodology was developed to quantify the impact on pavement performance and cost characteristics of the incremental load effect resulting from the current weight limit policy under study (i.e. allowing 5- and 6-axle trucks weighing up to 100,000 lbs. on the Maine-New Hampshire Turnpike). The pavement impacts from the incremental loadings are dependent upon the base load to which the increment is applied, as the impacts of the total load are not linear and vary by pavement type. However, converting heavy truck volumes to ESALs normalizes the impact that a wide variety of trucks, carrying a similar variety of loads have on the varying base loadings observed on the diversion network.

Using ESALs to normalize quantitative descriptions of pavement wear allows for a direct correlation to be established between the number of ESALs borne by a given section of pavement and the monetary costs required to maintain that pavement.

The magnitude and pattern of truck traffic expected from implementation of the study policy scenario will be calculated in a four step process:

- Assigning *base* (existing) truck traffic (vehicle classes 4-13) and ESAL loadings to Maine's road network (derived from MDOT Weigh-in-Motion stations);

- Assigning *study* truck traffic expected to divert given implementation of the study policy scenario to the diversion network identified in **TM #2**;

- Calculating the *increment* in 5- and 6-axle volumes and associated ESAL loadings (positive or negative) between the base and study scenarios; and

- Calculating the cost impacts relating to the incremental ESAL loadings between the base and study scenarios.

The pattern and magnitude of base scenario truck traffic was developed using vehicle classification volumes and average daily ESAL factors (summarized by WIM station and vehicle classification) provided by MDOT, as well as similar information provided by NHDOT, and discussed in more detail in Technical Memorandum #1.

Since the original AASHO road tests, the calculation of ESALS has been refined to reflect pavement type, thickness and condition. The equation used in deriving ESAL factors at Maine's WIM stations is taken from the *1986 AASHTO Guide for Design of Pavement Structures*. MDOT's pavement management criteria uses a *structural pavement number* (SN) of 5 and a pavement "*terminal serviceability level*" (P_t) of 2.5. These criteria were used throughout the analysis. The follow equation was used in deriving ESAL factors from the WIM stations traffic data:

$$\beta\chi = 0.04 + \frac{0.081 \times (L_x + L_2)^{3.23}}{(SN+1)^{5.19} \times L_2^{3.23}}$$

Where L_x is the load on the whole axle group; L_2 is the axle group code (1 for single, 2 for tandem, 3 for tridem).

The pattern and magnitude of incremental traffic was identified through the use of commodity tonnage data purchased for this study. In addition, raw WIM data provided by Maine and New Hampshire, describing class 9 and 10 vehicles was summarized (as presented in **TM #1**) so that average daily ESAL factors could be assigned to the volumes of vehicles estimated from the commodity data.

Derivation of Incremental Traffic and Loading Values

Incremental truck traffic volumes and associated loadings have been calculated by building upon TRANSEARCH commodity flows that were converted to truck counts as follows. (Note: numbers adjusted for class 9&10 filter of WIM data).

Theoretically, with a GVW limit of 80,000 pounds a fully loaded 5-axle TST combination can carry a payload of approximately 50,000 pounds (**T5=25 tons**). With a GVW of 100,000 pounds, a six-axle TST combination can carry a payload of approximately 68,000 pounds (**T6=34 tons**).

Table C-1 shows a representative sample of vehicle count data taken from Weigh-in-motion stations in Maine. Table C-1 indicates the 5-axle vs. 6 axle vehicle type split on the stations off the turnpike and I-95 (P5=0.20; P6=0.80).

Table C-1:

WIM STATIONS	# Vehicles exceeding exempt weight range	# Vehicles exceeding exempt weight range	Totals
5 axle vehicles (20%)	98	44	142
6 axle vehicles (80%)	309	257	566
Total	**408**	**300**	**708**

Calculation of number of vehicles:
known values **from the scenario**:
P5, P6 = percentage of 5 axle; 6 axle traffic (as a decimal); P5+P6=1
T5, T6 = payload tons of 5 axle; 6 axle vehicles
RT = Reebie TRANSEARCH total annual tons of freight traffic;

calculated values:
V5, V6 = annual number of 5 axle; 6 axle vehicles
VT = total annual number of 5 axle **and** 6 axle vehicles; V5+V6=VT

formula:
1: VT = RT / ((P5*T5) + (P6*T6))
2: **V5** = P5*VT or = (P5*RT) / ((P5*T5) + (P6*T6))
3: **V6** = P6*VT or = (P6*RT) / ((P5*T5) + (P6*T6))
using appropriate **scenario values** of RT, P5, P6, T5, T6

Commodity tonnages were converted to numbers of 5 and 6 axle trucks through the use of payload conversion factors (i.e. tons to trucks) and ratios of 5 and 6 axle trucks employed by each major industry segment.

System wide ESAL factors (one for 5-axle, and one for 6-axle vehicles) have been developed as a vehicle-count weighted average of applicable WIM stations, and applied to the set of study vehicles derived from the TRANSEARCH data tonnages. (See **Table C-2**). The ESAL factors developed and applied to the incremental difference in 5-and 6-axle truck counts are **3.44** and **4.19**, respectively. In other words, the volume of 5-axle trucks was multiplied by **3.44** and the volume of 6-axle trucks was multiplied by **4.19** to obtain the respective ESAL values for these vehicles.

For a given configuration, represented by vehicle classification, a truck's calculated ESAL impact is directly related to its loaded weight. Since the set of study vehicles (5- and 6-axle trucks) occupy a specific, narrow weight range (i.e., 80,000 - 100,000 lbs.), the resulting ESAL factors for the individual study vehicles is expected to be similar across the various WIM stations. This expectation was confirmed by the actual WIM data, as average ESAL values for 5- and 6-axle trucks at each station clustered closely around the weighted average values.

In general, vehicle weights in practice are not exact; there will always be a distribution of weight around the limit due to loading error, moisture, load distribution and scale accuracy. The WIM station ESAL factors include the full range of weights above exempt weights, as recorded at the WIM stations.

Table C-2: Derivation of ESAL factors for Class 9 and 10 (5- and 6-axle) Vehicles Used to Identify the Impact of Incremental Traffic

1	Cent. ME	5AX	1,264	181	38	939	539	194	63	15	4		0.74	2.98	5.13	3.356
	Turnpike	6AX	116	157	170	38	478	890	5	15	18		0.32	3.05	5.24	4.188
		5AX	3,043	442	57	2,127	1,364	277	153	37	5		0.70	3.08	4.89	3.287
	So. ME Interstate	6AX	137	126	111	55	356	590	6	11	12		0.40	2.84	5.33	4.004
	New Hampshire	5AX	3,763	335	123	2,707	1,028	643	180	28	12		0.72	3.07	5.24	3.651
		6AX	202	176	135	155	560	788	10	16	15		0.77	3.19	5.84	4.338
2	Cent. ME	5AX	1,232	193	105	864	614	517	62	16	10		0.70	3.18	4.93	3.798
	Interstate	6AX	77	22	14	27	58	83	4	2	1		0.35	2.62	6.12	3.951
		5AX	612	39	50	580	117	260	34	3	5		0.95	3.02	5.20	4.248
	No. ME Interstate	6AX	87	13	5	37	32	28	4	1	1		0.43	2.54	5.89	3.455
3	No. ME State	5AX	47	3	1	33	12	5	2	0	0		0.69	3.43	6.32	3.921
		6AX	118	45	61	24	140	358	5	4	7		0.21	3.12	5.87	4.700
	No. ME US Rte.	5AX	268	38	25	182	120	127	13	3	2		0.68	3.17	5.17	3.952
		6AX	45	24	20	13	71	114	2	2	2		0.29	3.04	5.61	4.229
	Eastern ME State	5AX	243	33	6	249	98	33	14	3	1		1.02	3.01	5.10	3.356
		6AX	54	48	30	19	138	162	2	4	3		0.36	2.88	5.45	3.865
4	W. ME US Rte.	5AX	101	10	6	71	32	31	5	1	1		0.70	3.23	5.58	4.087
		6AX	130	68	46	27	197	268	5	6	5		0.21	2.90	5.82	4.074
	NW ME US Rte.	5AX	70	8	2	62	28	11	3	1	0		0.88	3.60	5.96	4.057
		6AX	106	68	67	21	205	348	4	6	7		0.20	2.99	5.21	4.083
	Cent. ME State	5AX	105	7	5	57	23	34	5	1	0		0.54	3.20	7.04	4.773
		6AX	31	56	33	14	159	207	1	5	4		0.44	2.83	6.31	4.113
1,2,3,4	**TOTAL**	5AX	10,747	1,288	416	7,869	3,974	2,132	533	107	39			3.08	5.12	3.582
1,2,3,4		6AX	1,101	802	690	430	2,395	3,834	49	74	74			2.99	5.55	4.174
3,4	**ME_NH_TPK**	5AX	7,837	954	216	5,537	2,915	1,108	383	79	20			3.06	5.13	**3.438**
3,4	**factors**	6AX	427	457	415	232	1,392	2,267	20	42	45			3.05	5.46	**4.196**

Step 1: Base Scenario Vehicle / ESAL Traffic Distribution

The Base Scenario was developed by first assigning the 5- and 6-axle commodity tonnage data to the analysis network. In the base scenario, all analysis network links representing Turnpike facilities were *enabled* so that the commodity tonnage data could be assigned to those links. Thus, the only links that the commodity tonnage data could be assigned to in the base scenario were ones representing Turnpike facilities. All non-Turnpike Interstate facilities were thus prohibited from being assigned any commodity tonnage volume.

Applying these conditions to the analysis network yielded a base scenario network, representative of current conditions, to which the 5-and 6-axle commodity tonnage data could be assigned.

The 5- and 6-axle commodity tonnage data were then assigned to the base scenario network. Assignment of the data yielded a network representative of the Maine and New Hampshire roadway system under base (existing) conditions.

The conversion process already described was then used to convert assigned tons to numbers of 5- and 6-axle trucks. Then, the ESAL factors described in **Table C-2** were used to convert those volumes of trucks to ESALs.

<u>Step 2: Study Scenario Vehicle / ESAL Traffic Distribution</u>

To develop the study scenario, the links previously *enabled* in the base scenario (that is, the non-Turnpike Interstate facilities) were *disabled*. This yielded an analysis network representative of the study condition – one where all Turnpike facilities, as well as non-Turnpike Interstate facilities in Maine and New Hampshire are prohibited from carrying 5- and 6-axle vehicles weighing over 80,000 lbs.

Next, the 5- and 6-axle Commodity tonnage data were assigned to the study network. The assignment of this data yielded a network describing the Maine roadway system under the study condition.

The conversion process was again used to convert assigned tons to numbers of 5- and 6-axle trucks. Then, the ESAL factors described in **Table C-2** were used to convert those volumes of trucks to ESALs.

<u>Step 3: Comparison of Base and Study Scenarios</u>

The diversion network developed for this study is composed of roadway facilities both having heavy truck traffic drawn *from* them, as well as those having heavy truck traffic drawn *to* them. A complete analysis of pavement impacts must account for both instances. In total, the ME/NH Turnpike analysis examined 11,029 road segments.

For this analysis, comparisons of base scenario ESAL loadings on the diversion network have been separated into those facilities that *lose* heavy truck traffic given implementation of the study scenario, and those that *gain* heavy truck traffic.

Tables C-3 and **C-44** summarize the incremental differences in Volume and ESAL loadings on the diversion network observed between the base and study scenarios for Maine and New Hampshire, respectively.

Table C-3: Summary Impacts to Maine Pavements for the Study Scenario*

Functional Classification	Incremental Daily Truck-Miles - Five Axle	Incremental Daily Truck-Miles - Six Axle	Total Incremental Daily Truck-Miles	Incremental Daily ESAL-Miles - Five Axle	Incremental Daily ESAL-Miles - Six Axle	Total Incremental Daily ESAL-Miles
Major/urban collector	746.84	1,381.84	2,128.68	2,890.73	5,775.48	8,666.21
Minor arterial	3,162.53	7,033.75	10,196.28	12,241.33	29,402.60	41,643.93
Other principal arterial	2,398.05	6,455.85	8,853.90	9,283.63	26,989.45	36,273.08
Principal Arterial - Interstate	-5,258.31	-15,577.52	-20,835.83	-20,349.21	-65,115.40	-85,464.61

Table C-4: Summary of Impacts to New Hampshire Pavements given Implementation of the Study Scenario*

Functional Classification	Incremental Daily Truck-Miles - Five Axle	Incremental Daily Truck-Miles - Six Axle	Total Incremental Daily Truck-Miles	Incremental Daily ESAL-Miles - Five Axle	Incremental Daily ESAL-Miles - Six Axle	Total Incremental Daily ESAL-Miles
Major/urban collector	5.83	4.39	10.22	22.70	18.38	41.08
Minor arterial	537.35	65.21	602.56	2,077.19	272.84	2,350.03
Other principal arterial	2,238.32	1,578.15	3,816.47	8,663.28	6,596.82	15,260.10
Principal Arterial - NH Turnpike	-729.80	-1,147.55	-1,877.35	-2,824.32	-4,796.98	-7,621.30

Step 4: Estimating Maintenance & Rehabilitation Budget Savings

Given the normalized nature of the relationship between the number of ESALs and pavement wear, it is assumed in this analysis that a certain percentage reduction (or gain) in ESAL loadings on facilities making up the diversion network will equate to an equal percentage in resurfacing cost savings (or increases) for that given type of roadway, based on existing MDOT and NHDOT expenditures.

As such, it was necessary to develop a metric that describes, for each functional roadway system, an amount spent for each unit of pavement consumption on that system.

* For purposes of this analysis, the functional system "Principal Arterial – Other Freeways & Expressways" has been grouped with "Other Principal Arterial."

Calculating MDOT and NHDOT Resurfacing Costs as a Function of Pavement Use

Calculation of Base Pavement Use: Maine

The prorating methodology used in the HHTN Identification Study (as described in **TM #2**) was used to assign base scenario truck volume and ESAL estimates (vehicle classes 4-13) to the MDOT TIDE route system. Unlike in the development of the base and study scenarios, volume and ESAL calculations and assignments were made using MDOT's own classification volume counts and ESAL factors, not those derived from Commodity tonnage data.

Maine has provided updated, 2003 ESAL factors for several more WIM stations than was available for the HHTN Identification Study (**Table C-5**). ESAL factors by vehicle classification for each WIM station were assigned to links on the MDOT TIDE route system based on the proximity of route links to a given WIM station.

Table C-5: 2003 Average Daily ESAL Factors by Vehicle Classification and WIM Station

Location	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13
W. ME US Rte. - 2002	0.5094	0.2874	1.6519	3.8599	0.5290	1.3105	3.6117	1.0500	1.0500	3.9375
NW ME US Rte. - 2002	0.5409	0.4795	1.0349	4.4685	0.6546	1.7882	3.9033	1.0500	1.0500	4.0688
Cent. ME Interstate - 2002	0.7146	0.3494	0.9182	4.0458	0.8280	1.4539	1.6308	2.0355	1.1753	3.9375
Cent. ME Turnpike - 2002	0.7476	0.3064	0.9051	5.3129	0.7970	1.2982	3.8145	1.5615	1.0500	5.5475
No. ME Interstate - 2002	0.8556	0.2001	0.6084	2.8068	0.6009	1.2795	0.7747	1.3885	1.0500	3.9375
So. ME Interstate - 2002	0.6106	0.2711	0.8361	4.6133	0.6893	1.5029	3.6301	1.3134	1.0500	4.3519
No. ME State - 2002	1.0269	0.5630	1.3988	4.5621	2.7619	1.5646	2.9148	1.0500	1.0500	3.9375
No. ME US Rte. - 2002	0.7558	0.2931	1.2238	3.6120	0.6679	2.0435	2.5313	1.0851	1.0500	3.9375
Cent. ME State - 2002	0.5603	0.3836	1.0935	4.2200	1.0203	1.0433	3.6933	1.0500	1.0500	3.9375
Eastern ME State - 2002	0.6137	0.2914	0.6041	5.6847	0.6706	1.7334	2.6056	1.0500	1.0500	7.1250

Using the previously-described distance-weighted prorate procedure, classified volumes and associated ESAL values were assigned to the MDOT TIDE route system. Next, values for vehicle-miles and ESAL-miles were summarized for each functional system.

Summarizing these values by functional system is a critical step in the determination of cost impacts from implementation of the study scenario, as the MDOT resurfacing program budget is partitioned by functional system.

Calculation of Base Pavement Use: New Hampshire

Primarily because New Hampshire's coverage of vehicle classification count stations is not as extensive as Maine's, the distance-weighted prorate procedure used in calculating base scenario pavement consumption for Maine could not be applied to the New Hampshire network. Instead, base pavement consumption data for New Hampshire was derived from that identified for the Maine network. For each roadway functional classification and vehicle classification in Maine, an "average ESAL/AADT" value was calculated. This value was then applied to AADT values for the New Hampshire network (the New Hampshire network has full AADT coverage) for each roadway functional classification and vehicle classification.

Development of Base Unit Costs

For this analysis, MDOT and NHDOT have provided details on their resurfacing budget programs (**Tables C-6 and C-7**).

Table C-6: MDOT Resurfacing Program Budget

Maine Biennial Pavement Maintenance Costs by Functional Highway Class

Budget Year	Functional Class	Programmed	% of Biennial
1998-1999	Interstate	$ 15,344,000	24%
	Major Collector	$ 14,545,380	22%
	Minor Arterial	$ 16,832,350	26%
	Other Principal Arterial	$ 18,478,700	28%
	Total 1998-1999	**$ 65,200,430**	
2000-2001	Interstate	$ 9,558,000	13%
	Major Collector	$ 19,090,100	25%
	Minor Arterial	$ 24,966,000	33%
	Other Principal Arterial	$ 22,572,000	30%
	Total 2000-2001	**$ 76,186,100**	
2002-2003	Interstate	$ 9,661,000	11%
	Major Collector	$ 31,442,996	35%
	Minor Arterial	$ 29,159,000	32%
	Minor Collector	$ 211,000	0%
	Other Principal Arterial	$ 20,549,000	23%
	Total 2002-2003	**$ 91,022,996**	
2004-2005	Interstate	$ 11,356,000	11%
	Major Collector	$ 31,649,670	30%
	Minor Arterial	$ 33,707,880	32%
	Other Freeways/Expressways	$ 1,962,000	2%
	Other Principal Arterial	$ 25,929,400	25%
	Total 2004-2005	**$ 104,604,950**	

Table C-7: NHDOT Resurfacing Program Budget

Functional Classification	Programmed Amount
Major Collector	$700,000
Minor Arterial	$8,000,000
Interstate	$3,700,000
Other Principal Arterial	$6,500,000
Total	**$18,900,000**

Amounts programmed in the MDOT and NHDOT resurfacing budgets for each functional system are representative of the *entire* mileage for that functional system. However, this analysis is only accounting for the cost impacts on those facilities making up the diversion network identified for this study.

The purpose here is to develop a *cost per ESAL-mile* to normalize the programmed amount for each functional system by the amount of truck traffic traveled on that system. The cost per ESAL-mile metric is then applied to incremental ESAL loadings (positive or negative) to determine cost impacts for the study scenario.

The distance-weighted prorate procedure used to assign ESAL values to the MDOT TIDE route system for this analysis does not yield a full assignment of values for all facilities on each MDOT functional system. In other words, there is a given portion for each functional system for which base ESAL values are unknown. Therefore, it was desired to "grow" observed ESAL values on the portion of the network for which values were known to values that are representative of what is traveled on the entire mileage of each functional system.

To accomplish this, for each functional system, the sum of known ESAL-miles was divided by the sum of the length of the known segments. This value was then multiplied by the sum of the length of the entire functional system to arrive at a "grown" number of ESAL-miles.

Study of Impacts Caused by Exempting the Maine Turnpike and New Hampshire Turnpike from Federal Truck Weight Limits

Appendix D: Bridge Inventory and Cost Detail Tables

Exhibit D-1: Turnpike Study Network Bridge Inventory - Maine

PRIMARY ROUTE	BRIDGE #	BRIDGE NAME	FEATURE_ON	TOWN_NAME
TURNPIKE NB	0042	NEWOEGIN CULVERT	MTPK	Sabattus
ST RTE 0196S	0047	LOCUST ST BRIDGE	LOCUST STREET	Lewiston
TURNPIKE NB	0104	CITY FARM CULVERT	MTPK	Lewiston
TURNPIKE NB	0105	NO NAME BROOK CULVERT	MTPK	Lewiston
US 1	0106	B&ARR/US RTE 1 RR#208-96	BANGOR & AROOSTOOK RR	Presque Isle
TURNPIKE NB	0308	MEADER BROOK	MTPA	Falmouth
TURNPIKE NB	0309	FOREST LAKE BROOK	MAINE TURNPIKE	Gray
TURNPIKE NB	0310	PLEASANT RIVER	MTPK	Gray
TURNPIKE NB	0311	COLLIER BROOK	MTPK	Gray
TURNPIKE NB	0312	FOSTER BROOK	MTPK	New Gloucester
ST RTE 0022	0343	CONGRESS STREET	CONGRESS ST	Portland
INT 95 NB	0353	FORE RIVER	MAINE TURNPIKE	Portland
TURNPIKE NB	0537	POTTERS BROOK	MTPK	Litchfield
ST RTE 0197	0543	RTE1 197	RTE 197	Litchfield
US 201	1092	MAIN ST BR.	MAINE CENTRAL RR	Fairfield
INT 95 NB	1311	CAPE NEDDICK RIVER	MTPK	York
INT 95 NB	1313	JOSIAS RIVER	MTPK	York
INT 95 NB	1320	WEBHANNET RIVER	MTPK	Wells
INT 95 NB	1328	BRANCH RIVER	MTPK	Wells
INT 95 NB	1337	THATCHER BROOK	MTPK	Biddeford
INT 95 NB	1339	BRANCH OF SACO	MTPK	Biddeford
INT 95 NB	1346	CASCADE BROOK	MTPK	Saco
US 1	1351	ELM ST BR	BOSTON AND MAINE ROAD	Biddeford
US 201	1528	COLLEGE AVE CROSSING	MCRR	Waterville
ST RTE 0001C	2038	PENOBSCOT BRIDGE	ROUTE 15	Bangor
ST RTE 0009	2068	BERWICK	ROUTE 9	Berwick
US 201	2101	BRIDGE STREET	BRUNSWICK AVE	Gardiner
ST RTE 0004	2103	BRETTUNS POND	#4	Livermore
ST RTE 0011	2117	CAIN	ROUTES 11 & 100	Clinton
US 1	2155	CLARK	RTE 143	Presque Isle
ST RTE 0196	2229	DILL	RTE 196 & MTA ON RAMP	Lewiston
ST RTE 0150	2276	PARKMAN RD / FERGUSON	ROUTE 150 (MAIN STREET)	Cambridge
ST RTE 0108	2296	FROST	#108	Rumford
ST RTE 0006	2337	GUILFORD MEMORIAL	6-15-16-150	Guilford
US 1	2431	KENNEBUNK	US 1	Kennebunk
US 1	2499	MAIN STREET	US 1	Ellsworth
US 2	2501	MAIN STREET	US2-100	Newport
US 2	2502	MAIN STREET	ROUTES 2.8&US201	Norridgewock
ST RTE 0011	2540	MECHANIC FALLS	ROUTES 11 & 121	Mechanic Falls
ST RTE 0026	2550	MIDDLE RANGE	26	Poland
ST RTE 0004	2563	MILL POND	#4-27	Farmington
ST RTE 0006	2572	MILO EAST	#16	Milo
ST RTE 0108	2585	MORSE	ROUTE 108	Rumford
ST RTE 0009	2599	NEAL	ROUTE 9	North Berwick
ST RTE 0009	2605	NEW MILLS	RTE 9 & 126	Gardiner
US 2	2617	MARGARET CHASE SMITH N	US2 & US201	Skowhegan
ST RTE 0011	2648	PARSONS MILL	MINOT AVE RTE 11-121	Auburn
US 2	2652	PEABODY SCHOOL	ROUTE 2	Gilead

US 2	2690	PROSPECT AVE	ROUTE 2	Rumford
US 2	2711	RED	US 2	Bangor
ST RTE 0026	2745	SAW MILL	ROUTE 26	Paris
US 2	2776	SMITH BROOK	US #2	Lincoln
ST RTE 0004	2778	SNOW	ROUTES 4&9	North Berwick
US 2	2785	MARGARET CHASE SMITH S	US2 & US201	Skowhegan
US 2	2948	WILD RIVER	ROUTE 2	Gilead
US 201	2965	WOOLEN MILL	201	Skowhegan
US 202	3076	JAMES B. LONGLEY MEM.	MAIN ST US 202	Auburn
US 2	3079	STATE ST.	US 2	Bangor
US 202	3083	MAIN STREET	RTE 11-100-US202	Lewiston
US 2A	3097	JORDAN MILL	US 2 A	Macwahoc Plt
ST RTE 0009	3120	NEWELL BROOK BR.	RTE 9	Durham
US 202	3201	FAIRGROUNDS CROSSING	MAINE CENTRAL RAILROAD	Lewiston
ST RTE 0115	3313	MCRR CROSSING	115	Yarmouth
ST RTE 0009	3334	DURHAM	RTE 9-125	Durham
US 2A	3457	MILL	US 2 A	Haynesville
ST RTE 0121	3502	CNRR	CNRR	Mechanic Falls
ST RTE 0197	3519	BARKER BROOK	197	Richmond
ST RTE 0035	3609	CRYSTAL LAKE OUTLET	#117	Harrison
US 201	3707	WYMAN CROSSING UNDERP	MAINE CENTRAL RAILROAD	Fairfield
US 202	3716	JEPSON BROOK	202;RMPS A;D;MCRR;PET.ST.	Lewiston
RD INV 10186 23	3837	PAUL DAVIS MEMORIAL	HIGH ST	Bath
US 1	3838	WEST APPROACH	SMO RAILROAD	Bath
US 202	3863	WARD	9-202	Newburgh
US 2	3875	HARDY BROOK	US 2-4	Farmington
ST RTE 0125	3954	FRAZIER	TOWN WAY	Lisbon
ST RTE 0035	5192	HORRS	ROUTE 35	Waterford
US 201	5196	AUGUSTA MEM. BRIDGE	100;201;202	Augusta
ST RTE 0197	5266	PLEASANT POND	197	Richmond
US 201	5391	WATER STREET	STATE OF MAINE RAILROAD	Hallowell
ST RTE 0126	5393	SABATTUS RIVER	ROUTE 126	Sabattus
ST RTE 0125	5395	COOMBS	RT 125	Bowdoin
US 2A	5623	HAYNESVILLE	US 2A	Haynesville
ST RTE 0009	5646	POWNAL CENTER	9	Pownal
US 202	5651	LEWIS	ROUTES 4A & US202	Alfred
US 1	5760	STOCKTON SPRINGS UNDRP	CHURCH ST	Stockton Springs
ST RTE 0111	5825	KENNEBUNK RIVER	111	Lyman
US 1	5886	RT #1 UNDERPASS	MCRR	Brunswick
ST RTE 0004	6405	GOLF COURSE TUNNEL		South Berwick

Exhibit D-2: Modeled Truck Traffic Impacts for the Study Scenario – Maine

BRIDGE NAME	Base Scenario 5-axle TST	Base Scenario 6-axle TST	Study Scenario 5-axle TST	Study Scenario 6-axle TST	Difference 5-axle TST	Difference 6-axle TST
NEWOEGIN CULVERT	5	35	0	0	-5	-35
LOCUST ST BRIDGE	2	9	1	4	-1	-5
CITY FARM CULVERT	4	29	0	0	-4	-29
NO NAME BROOK CULVERT	5	35	0	0	-5	-35
B&ARR/US RTE 1 RR#208-96	1	91	1	92	0	1
MEADER BROOK	22	58	0	0	-22	-58
FOREST LAKE BROOK	22	58	0	0	-22	-58
PLEASANT RIVER	22	58	0	0	-22	-58
COLLIER BROOK	19	61	0	0	-19	-61
FOSTER BROOK	19	61	0	0	-19	-61
CONGRESS STREET	26	96	78	167	52	72
FORE RIVER	28	66	0	0	-28	-66
POTTERS BROOK	3	26	0	0	-3	-26
RTE1 197	0	0	1	4	1	4
MAIN ST BR.	0	0	0	0	0	0
CAPE NEDDICK RIVER	70	67	0	0	-70	-67
JOSIAS RIVER	70	67	0	0	-70	-67
WEBHANNET RIVER	70	67	0	0	-70	-67
BRANCH RIVER	60	62	0	0	-60	-62
THATCHER BROOK	68	87	0	0	-68	-87
BRANCH OF SACO	68	87	0	0	-68	-87
CASCADE BROOK	68	87	0	0	-68	-87
ELM ST BR	0	0	11	46	11	46
COLLEGE AVE CROSSING	0	0	0	0	0	0
PENOBSCOT BRIDGE	0	0	1	4	1	4
BERWICK	7	26	7	26	0	0
BRIDGE STREET	7	54	2	15	-5	-40
BRETTUNS POND	17	39	17	39	0	0
CAIN	1	12	2	15	1	3
CLARK	1	91	1	92	0	1
DILL	2	9	1	4	-1	-5
PARKMAN RD / FERGUSON	5	78	5	78	0	0
FROST	11	26	12	26	0	0
GUILFORD MEMORIAL	5	78	5	78	0	0
KENNEBUNK	15	58	11	46	-4	-12
MAIN STREET	8	23	7	19	-1	-4
MAIN STREET	1	12	2	15	1	3
MAIN STREET	5	78	5	78	0	0
MECHANIC FALLS	0	0	0	0	0	0
MIDDLE RANGE	7	5	0	0	-7	-5
MILL POND	17	39	17	39	0	0
MILO EAST	5	78	5	78	0	0
MORSE	16	104	17	104	1	0
NEAL	5	15	0	0	-5	-15
NEW MILLS	7	52	0	0	-7	-52
MARGARET CHASE SMITH N	5	78	5	78	0	0
PARSONS MILL	0	0	0	0	0	0
PEABODY SCHOOL	12	83	11	82	-1	-1

PROSPECT AVE	16	104	17	104	1	0
RED	1	87	1	88	0	1
SAW MILL	7	5	0	0	-7	-5
SMITH BROOK	6	165	6	166	1	1
SNOW	5	16	64	56	59	39
MARGARET CHASE SMITH S	5	78	5	78	0	0
WILD RIVER	12	83	11	82	-1	-1
WOOLEN MILL	0	0	0	0	0	0
JAMES B. LONGLEY MEMORIAL	10	14	14	54	5	39
STATE ST.	1	87	2	92	1	4
MAIN STREET	10	14	14	54	5	39
JORDAN MILL	6	165	6	166	1	1
NEWELL BROOK BR.	0	0	0	1	0	1
FAIRGROUNDS CROSSING	7	5	13	47	5	41
MCRR CROSSING	0	0	0	1	0	1
DURHAM	0	0	0	1	0	1
MILL	6	165	6	166	1	1
CNRR	0	0	0	0	0	0
BARKER BROOK	1	7	1	3	-1	-3
CRYSTAL LAKE OUTLET	0	0	6	4	6	4
WYMAN CROSSING UNDERP	0	0	0	0	0	0
JEPSON BROOK	7	5	13	47	5	41
PAUL DAVIS MEMORIAL	4	10	4	11	0	1
WEST APPROACH	3	16	4	16	1	0
WARD	2	17	2	18	0	0
HARDY BROOK	22	117	22	117	1	0
FRAZIER	0	0	1	5	1	5
HORRS	0	0	6	4	6	4
AUGUSTA MEM. BRIDGE	9	32	13	47	3	15
PLEASANT POND	3	12	1	4	-2	-8
WATER STREET	2	28	0	1	-2	-26
SABATTUS RIVER	0	0	1	4	1	4
COOMBS	0	0	1	5	1	5
HAYNESVILLE	6	165	6	166	1	1
POWNAL CENTER	0	0	0	1	0	1
LEWIS	8	15	38	133	31	118
STOCKTON SPRINGS UNDRP	8	98	7	96	-1	-2
KENNEBUNK RIVER	8	15	0	0	-8	-15
RT #1 UNDERPASS	4	9	4	10	0	1
GOLF COURSE TUNNEL	0	0	59	40	59	40

Exhibit D-3: Maintenance Cost Derivations by Bridge - Maine

BRIDGE NAME	Total Volume Change	Cost Factor	Deck Area (Sq. Ft.)
NEWOEGIN CULVERT	-40.94	-0.67	0
LOCUST ST BRIDGE	-6.84	-0.33	3409
CITY FARM CULVERT	-32.51	-0.33	0
NO NAME BROOK CULVERT	-40.94	-0.67	0
B&ARR/US RTE 1 RR#208-96	0.95	0	1493
MEADER BROOK	-79.98	-1	0
FOREST LAKE BROOK	-79.98	-1	0
PLEASANT RIVER	-79.98	-1	1400
COLLIER BROOK	-80.32	-1	1400
FOSTER BROOK	-80.32	-1	0
CONGRESS STREET	123.54	1	8600
FORE RIVER	-94.00	-1	0
POTTERS BROOK	-29.50	-0.33	0
RTE1 197	4.95	0	6968
MAIN ST BR.	-0.05	0	2640
CAPE NEDDICK RIVER	-136.96	-1	0
JOSIAS RIVER	-136.96	-1	0
WEBHANNET RIVER	-136.96	-1	0
BRANCH RIVER	-122.11	-1	0
THATCHER BROOK	-154.56	-1	0
BRANCH OF SACO	-154.56	-1	0
CASCADE BROOK	-154.56	-1	0
ELM ST BR	56.93	0.67	3892
COLLEGE AVE CROSSING	-0.05	0	3222
PENOBSCOT BRIDGE	4.21	0	56600
BERWICK	-0.03	0	7182
BRIDGE STREET	-44.45	-0.67	10758
BRETTUNS POND	0.02	0	0
CAIN	3.81	0	1490
CLARK	0.95	0	0
DILL	-6.84	-0.33	0
PARKMAN RD / FERGUSON STR	0.46	0	699
FROST	0.58	0	0
GUILFORD MEMORIAL	0.50	0	7000
KENNEBUNK	-15.59	-0.33	3348
MAIN STREET	-4.27	0	7695
MAIN STREET	3.84	0	8138
MAIN STREET	0.50	0	1700
MECHANIC FALLS	0.02	0	7938
MIDDLE RANGE	-12.09	-0.33	527
MILL POND	0.03	0	812
MILO EAST	0.50	0	3045
MORSE	1.09	0	7125
NEAL	-20.16	-0.33	2297
NEW MILLS	-59.18	-0.67	3150
MARGARET CHASE SMITH N	0.46	0	7709
PARSONS MILL	0.02	0	1697
PEABODY SCHOOL	-1.72	0	714
PROSPECT AVE	1.09	0	1586
RED	0.65	0	945

SAW MILL	-12.07	-0.33	0
SMITH BROOK	1.15	0	0
SNOW	98.64	1	2262
MARGARET CHASE SMITH S	0.46	0	8991
WILD RIVER	-1.72	0	6912
WOOLEN MILL	-0.05	0	1071
JAMES B. LONGLEY MEMORIAL	44.32	0.67	46980
STATE ST.	4.86	0	6965
MAIN STREET	44.32	0.67	5669
JORDAN MILL	1.15	0	1964
NEWELL BROOK BR.	1.46	0	425
FAIRGROUNDS CROSSING	46.82	0.67	4451
MCRR CROSSING	1.32	0	5902
DURHAM	1.46	0	8349
MILL	1.15	0	0
CNRR	0.02	0	650
BARKER BROOK	-3.84	0	0
CRYSTAL LAKE OUTLET	9.85	0.33	1456
WYMAN CROSSING UNDERPASS	-0.05	0	5549
JEPSON BROOK	46.82	0.67	0
PAUL DAVIS MEMORIAL	1.38	0	5289
WEST APPROACH	1.38	0	44178
WARD	0.48	0	0
HARDY BROOK	0.52	0	0
FRAZIER	6.02	0.33	0
HORRS	9.85	0.33	1885
AUGUSTA MEMORIAL BRIDGE	18.43	0.33	94410
PLEASANT POND	-9.87	-0.33	0
WATER STREET	-28.39	-0.33	1860
SABATTUS RIVER	4.95	0	2139
COOMBS	6.02	0.33	0
HAYNESVILLE	1.15	0	9372
POWNAL CENTER	1.46	0	980
LEWIS	148.73	1	1154
STOCKTON SPRINGS UNDRPASS	-3.24	0	4381
KENNEBUNK RIVER	-22.24	-0.33	0
RT #1 UNDERPASS	1.39	0	2960
GOLF COURSE TUNNEL	98.87	1	0

Exhibit D-4: Turnpike Study Network Bridge Inventory – New Hampshire

PRIMARY ROUTE	BRIDGE ID #	TOWN NAME	BRIDGENO
S16	2895	TAMWORTH	037/166
U2	3399	SHELBURNE	049/089
	962	EPPING	051/053
S16	3339	PINKHAMS GRANT	058/048
S16	1775	ROCHESTER	059/096
S101	823	AUBURN	060/133
S101	822	AUBURN	060/134
S16	3340	PINKHAMS GRANT	065/073
U3	1128	ALLENSTOWN	071/047
	1256	HENNIKER	072/103
S125	1153	LEE	073/084
U3	2582	ASHLAND	076/080
S16	3407	GORHAM	077/038
U2	3402	SHELBURNE	077/105
U302	3076	CONWAY	079/063
U2	3403	SHELBURNE	079/106
S16	3341	PINKHAMS GRANT	080/094
S11	1869	FARMINGTON	080/125
S101	862	AUBURN	080/154
	675	NORTH HAMPTON	081/093
S16	1456	DOVER	084/165
U3	2562	ASHLAND	085/063
S16	3408	GORHAM	087/050
S28	1180	ALLENSTOWN	088/067
S101	893	AUBURN	088/162
S16	3409	GORHAM	092/058
S16	3232	JACKSON	092/130
S16	2415	WAKEFIELD	093/039
US 202	1737	ROCHESTER	093/110
S101	923	CANDIA	095/069
S16	1728	ROCHESTER	095/097
US 202	1729	ROCHESTER	095/106
	371	SEABROOK	096/120
S16	3336	GREENS GRANT	096/136
S11	2239	ALTON	096/287
S28	1759	BARNSTEAD	097/089
S16	2840	TAMWORTH	097/165
S16	3406	GORHAM	098/071
S16	2104	MILTON	098/115
S125	1235	LEE	099/124
U3	1143	HOOKSETT	100/165
S11	2305	GILFORD	102/099
S16	2372	WAKEFIELD	104/042
	979	PORTSMOUTH	104/126
U2	3398	GORHAM	105/089
	980	PORTSMOUTH	105/125
S16	1394	DOVER	105/133
U3	1129	HOOKSETT	105/170

S16	3338	MARTINS LOCATION	105/171
S16	1697	ROCHESTER	106/092
S16	1397	DOVER	106/133
U3	2559	ASHLAND	107/094
S28	1218	ALLENSTOWN	107/098
U4	1137	NEWINGTON	112/107
S28	2292	WOLFEBORO	112/110
S16	1358	DOVER	113/111
S16	1361	DOVER	113/112
	600	HAMPTON	113/168
S125	912	EPPING	114/051
U3	2303	GILFORD	114/066
	1296	MADBURY	114/084
S11	2301	GILFORD	115/147
S16	1700	ROCHESTER	117/088
U3	2790	CAMPTON	118/126
	1297	MADBURY	120/096
	1362	DOVER	121/106
	1701	ROCHESTER	121/121
S16	2728	OSSIPEE	123/324
S16	1350	DOVER	127/104
	1664	ROCHESTER	127/106
S28	1754	BARNSTEAD	131/108
	1374	DOVER	131/123
U4	1237	LEE	131/127
U3	2329	LACONIA	131/154
S16	1347	DOVER	132/101
S16	1348	DOVER	132/102
S101	964	CANDIA	133/074
S101	965	CANDIA	133/075
S101	898	RAYMOND	134/102
S11	1773	FARMINGTON	134/132
U3	2296	LACONIA	135/128
S16	2672	OSSIPEE	137/299
U3	2595	HOLDERNESS	140/088
S16	2034	MILTON	141/122
U3	2610	PLYMOUTH	141/143
U3	2609	PLYMOUTH	142/145
S16	3193	JACKSON	144/056
	1239	LEE	144/142
S101	908	RAYMOND	146/103
S28	2367	WOLFEBORO	146/108
S125	1040	EPPING	146/111
S16	1642	ROCHESTER	147/099
U1	746	NORTH HAMPTON	148/132
	1643	ROCHESTER	149/113
U3	2631	PLYMOUTH	149/160
S28	1626	CHICHESTER	151/147
S16	2642	OSSIPEE	152/268
U3	2597	PLYMOUTH	154/087
S125	1390	BARRINGTON	154/118
	1640	ROCHESTER	155/110

	676	EXETER	156/060
	1639	ROCHESTER	157/110
S11	2072	ALTON	157/193
S125	1594	ROCHESTER	158/110
	1593	ROCHESTER	158/113
S16	1272	DOVER	160/083
U1	985	PORTSMOUTH	161/062
S16	1979	MILTON	162/110
U1	521	HAMPTON	162/112
U1	615	HAMPTON	163/184
S11	2031	ALTON	163/184
S16	2641	OSSIPEE	165/248
U2	3423	SHELBURNE	168/079
S16	2984	CONWAY	170/071
S16	2981	CONWAY	173/062
S16	1564	ROCHESTER	176/133
S16	2899	ALBANY	179/056
S16	2637	OSSIPEE	180/232
	1181	DOVER	181/039
	1053	PORTSMOUTH	184/124
S25	2466	MEREDITH	184/138
S28	2413	WOLFEBORO	185/104
S25	2481	MEREDITH	186/145
S28	2029	ALTON	186/155
S16	1977	MILTON	187/109
	1075	PORTSMOUTH	191/131
U1	459	HAMPTON FALLS	194/059
S28	2557	OSSIPEE	194/146
S16	1561	ROCHESTER	194/149
S28	2237	ALTON	196/278
U4	1045	PORTSMOUTH	198/123
U4	1148	DOVER	201/025
S16	3132	BARTLETT	202/172
S11	1975	NEW DURHAM	204/056
S125	1521	ROCHESTER	206/110
	1072	PORTSMOUTH	206/121
	1071	PORTSMOUTH	206/122
U4	1083	PORTSMOUTH	209/179
ST RTE 0109	2283	WAKEFIELD	211/050
S16	2242	WAKEFIELD	230/057
	1065	PORTSMOUTH	231/125
S16	2589	OSSIPEE	232/121
S16	1884	MILTON	237/126
S16	2592	OSSIPEE	238/112
U302	3135	BARTLETT	241/137
U1	1060	PORTSMOUTH	247/084
	1089	PORTSMOUTH	258/128

Exhibit D-5: Modeled Truck Traffic Impacts for the Study Scenario – NH

PRIMARY ROUTE	BRIDGE ID #	Base Scenario 5-axle TST	Base Scenario 6-axle TST	Study Scenario 5-axle TST	Study Scenario 6-axle TST	Difference 5-axle TST	Difference 6-axle TST
S16	2895	6	26	11	27	5	1
U2	3399	6	26	11	27	5	1
	962	0	0	35	131	35	131
S16	3339	6	26	11	27	5	1
S16	1775	2	10	2	10	0	-1
S101	823	0	56	17	57	17	1
S101	822	0	74	17	74	17	0
S16	3340	6	26	11	27	5	1
U3	1128	0	9	4	9	4	0
	1256	0	0	18	15	18	15
S125	1153	0	0	35	131	35	131
U3	2582	2	4	2	4	0	0
S16	3407	6	26	11	27	5	1
U2	3402	6	26	11	27	5	1
U302	3076	6	26	11	27	5	1
U2	3403	6	26	11	27	5	1
S16	3341	6	26	11	27	5	1
S11	1869	2	4	2	4	0	0
S101	862	0	74	17	74	17	0
	675	0	4	14	5	14	1
S16	1456	0	1	0	0	0	-1
U3	2562	2	4	2	4	0	0
S16	3408	6	26	11	27	5	1
S28	1180	0	9	4	9	4	0
S101	893	0	74	17	74	17	0
S16	3409	6	26	11	27	5	1
S16	3232	6	26	11	27	5	1
S16	2415	6	17	6	18	1	1
US 202	1737	2	10	2	10	0	0
S101	923	0	56	17	57	17	1
S16	1728	2	10	2	10	0	-1
US 202	1729	2	10	2	10	0	0
	371	9	39	0	0	-9	-39
S16	3336	6	26	11	27	5	1
S11	2239	2	4	2	4	0	0
S28	1759	0	9	4	9	4	0
S16	2840	6	26	11	27	5	1
S16	3406	6	26	11	27	5	1
S16	2104	3	11	3	11	0	0
S125	1235	0	0	35	131	35	131
U3	1143	0	9	4	9	4	0
S11	2305	2	4	2	4	0	0
S16	2372	6	17	6	18	1	1
	979	9	40	0	0	-9	-40
U2	3398	6	26	11	27	5	1
	980	40	10	0	0	-40	-10
S16	1394	0	1	0	1	0	1
U3	1129	0	9	4	9	4	0
S16	3338	6	26	11	27	5	1

S16	1697	0	1	0	0	0	-1
S16	1397	0	1	0	0	0	-1
U3	2559	2	4	2	4	0	0
S28	1218	0	9	4	9	4	0
U4	1137	0	1	0	0	0	-1
S28	2292	0	9	4	9	4	0
S16	1358	0	1	0	1	0	1
S16	1361	0	1	0	0	0	-1
	600	14	0	0	0	-14	0
S125	912	0	0	35	131	35	131
U3	2303	2	4	2	4	0	0
	1296	0	0	4	13	4	13
S11	2301	2	4	2	4	0	0
S16	1700	0	1	0	0	0	-1
U3	2790	2	4	2	4	0	0
	1297	0	0	4	13	4	13
	1362	0	0	4	13	4	13
	1701	2	4	33	122	31	118
S16	2728	6	26	11	27	5	1
S16	1350	0	1	14	2	14	1
	1664	2	4	2	4	0	0
S28	1754	0	9	4	9	4	0
	1374	0	0	18	15	18	15
U4	1237	0	0	4	13	4	13
U3	2329	2	4	2	4	0	0
S16	1347	0	1	0	1	0	1
S16	1348	0	1	14	2	14	1
S101	964	0	56	17	57	17	1
S101	965	0	74	17	74	17	0
S101	898	0	74	17	74	17	0
S11	1773	2	4	2	4	0	0
U3	2296	2	4	2	4	0	0
S16	2672	6	26	11	27	5	1
U3	2595	2	4	2	4	0	0
S16	2034	3	11	3	11	0	0
U3	2610	2	4	2	4	0	0
U3	2609	2	4	2	4	0	0
S16	3193	6	26	11	27	5	1
	1239	0	0	4	13	4	13
S101	908	0	56	17	57	17	1
S28	2367	0	9	4	9	4	0
S125	1040	0	0	35	131	35	131
S16	1642	0	1	0	0	0	-1
U1	746	0	0	48	49	48	49
	1643	0	0	31	118	31	118
U3	2631	2	4	2	4	0	0
S28	1626	0	9	4	9	4	0
S16	2642	6	26	11	27	5	1
U3	2597	2	4	2	4	0	0
S125	1390	0	0	31	118	31	118
	1640	0	0	31	118	31	118
	676	0	5	14	5	14	0
	1639	0	0	31	118	31	118
S11	2072	2	4	2	4	0	0

S125	1594	0	0	31	118	31	118
	1593	0	1	0	1	0	1
S16	1272	0	1	14	2	14	1
U1	985	0	0	48	49	48	49
S16	1979	3	11	3	11	0	0
U1	521	0	0	34	44	34	44
U1	615	0	0	34	44	34	44
S11	2031	2	4	2	4	0	0
S16	2641	6	26	11	27	5	1
U2	3423	6	26	11	27	5	1
S16	2984	6	26	11	27	5	1
S16	2981	6	26	11	27	5	1
S16	1564	0	1	0	1	0	1
S16	2899	6	26	11	27	5	1
S16	2637	6	26	11	27	5	1
	1181	0	1	0	0	0	-1
	1053	9	113	0	0	-9	-113
S25	2466	2	4	2	4	0	0
S28	2413	0	9	4	9	4	0
S25	2481	2	4	2	4	0	0
S28	2029	0	9	4	9	4	0
S16	1977	3	11	3	11	0	0
	1075	0	1	0	0	0	-1
U1	459	0	0	34	44	34	44
S28	2557	0	9	4	9	4	0
S16	1561	0	1	0	0	0	-1
S28	2237	0	9	4	9	4	0
U4	1045	30	3	0	2	-30	-1
U4	1148	10	3	0	2	-10	-1
S16	3132	6	26	11	27	5	1
S11	1975	2	4	2	4	0	0
S125	1521	0	0	31	118	31	118
	1072	70	67	0	0	-70	-67
	1071	9	113	0	0	-9	-113
U4	1083	0	1	0	0	0	-1
ST RTE 0109	2283	6	12	7	13	1	1
S16	2242	3	11	3	11	0	0
	1065	70	67	0	0	-70	-67
S16	2589	6	17	6	18	1	1
S16	1884	3	11	3	11	0	0
S16	2592	6	17	6	18	1	1
U302	3135	6	26	11	27	5	1
U1	1060	0	0	47	47	47	47
	1089	9	113	0	0	-9	-113

Exhibit D-6: Maintenance Cost Derivations by Bridge – New Hampshire

PRIMARY ROUTE	BRIDGE ID #	Total Volume Change	Cost Factor	Deck Area (SF)
S16	2895	5.78	0.33	748
U2	3399	5.78	0.33	1229
	962	165.61	1	1544
S16	3339	5.78	0.33	1107
S16	1775	-0.86	0	4483
S101	823	18.59	0.33	2646
S101	822	17.39	0.33	2640
S16	3340	5.78	0.33	4117
U3	1128	4.18	0	0
	1256	32.95	0.33	0
S125	1153	165.61	1	0
U3	2582	0.01	0	23199
S16	3407	5.78	0.33	1650
U2	3402	5.78	0.33	741
U302	3076	5.78	0.33	1222
U2	3403	5.78	0.33	2662
S16	3341	5.78	0.33	8762
S11	1869	0.01	0	1649
S101	862	17.39	0.33	7404
	675	14.76	0.33	15274
S16	1456	-1.05	0	8153
U3	2562	0.01	0	3360
S16	3408	5.78	0.33	0
S28	1180	4.18	0	1700
S101	893	17.39	0.33	3510
S16	3409	5.78	0.33	6449
S16	3232	5.78	0.33	3035
S16	2415	1.61	0	760
US 202	1737	0.19	0	5227
S101	923	18.59	0.33	6898
S16	1728	-0.86	0	7592
US 202	1729	0.19	0	5231
	371	-48.03	-0.67	11150
S16	3336	5.78	0.33	1400
S11	2239	0.01	0	790
S28	1759	4.18	0	3082
S16	2840	5.78	0.33	1279
S16	3406	5.78	0.33	458
S16	2104	0.12	0	9669
S125	1235	165.61	1	960
U3	1143	4.18	0	440
S11	2305	0.01	0	1081
S16	2372	1.61	0	1442
	979	-49.41	-0.67	5733
U2	3398	5.78	0.33	9114
	980	-49.58	-0.67	8970
S16	1394	0.97	0	11694
U3	1129	4.18	0	552
S16	3338	5.78	0.33	0
S16	1697	-1.05	0	3604

S16	1397	-1.05	0	11694
U3	2559	0.01	0	2784
S28	1218	4.18	0	9330
U4	1137	-1.06	0	8938
S28	2292	4.18	0	927
S16	1358	0.97	0	7329
S16	1361	-1.05	0	6844
	600	-14.25	-0.33	16670
S125	912	165.61	1	7357
U3	2303	0.01	0	4896
	1296	16.88	0.33	4520
S11	2301	0.01	0	1565
S16	1700	-1.05	0	4264
U3	2790	0.01	0	536
	1297	16.88	0.33	3720
	1362	16.88	0.33	12327
	1701	148.73	1	0
S16	2728	5.78	0.33	918
S16	1350	15.01	0.33	6745
	1664	0.01	0	6810
S28	1754	4.18	0	2784
	1374	32.95	0.33	11382
U4	1237	16.88	0.33	3700
U3	2329	0.01	0	1130
S16	1347	0.97	0	14340
S16	1348	15.01	0.33	9847
S101	964	18.59	0.33	3115
S101	965	17.39	0.33	3115
S101	898	17.39	0.33	3293
S11	1773	0.01	0	701
U3	2296	0.01	0	720
S16	2672	5.78	0.33	5710
U3	2595	0.01	0	2490
S16	2034	0.12	0	2895
U3	2610	0.01	0	4403
U3	2609	0.01	0	6135
S16	3193	5.78	0.33	5032
	1239	16.88	0.33	722
S101	908	18.59	0.33	6952
S28	2367	4.18	0	420
S125	1040	165.61	1	1890
S16	1642	-1.05	0	3200
U1	746	96.52	1	1777
	1643	148.73	1	1855
U3	2631	0.01	0	3892
S28	1626	4.18	0	1275
S16	2642	5.78	0.33	2139
U3	2597	0.01	0	640
S125	1390	148.73	1	980
	1640	148.73	1	1247
	676	13.64	0.33	6860
	1639	148.73	1	7237
S11	2072	0.01	0	1800
S125	1594	148.73	1	7313

	1593	0.97	0	6540
S16	1272	15.01	0.33	5101
U1	985	96.52	1	754
S16	1979	0.12	0	3854
U1	521	77.83	1	2082
U1	615	77.83	1	4800
S11	2031	0.01	0	1316
S16	2641	5.78	0.33	4670
U2	3423	5.78	0.33	2224
S16	2984	5.78	0.33	13995
S16	2981	5.78	0.33	1815
S16	1564	0.97	0	5107
S16	2899	5.78	0.33	792
S16	2637	5.78	0.33	1113
	1181	-1.06	0	11592
	1053	-122.14	-1	7976
S25	2466	0.01	0	6212
S28	2413	4.18	0	960
S25	2481	0.01	0	870
S28	2029	4.18	0	846
S16	1977	0.12	0	4848
	1075	-1.09	0	11356
U1	459	77.83	1	888
S28	2557	4.18	0	4558
S16	1561	-1.05	0	3318
S28	2237	4.18	0	0
U4	1045	-30.47	-0.33	7950
U4	1148	-10.57	-0.33	51361
S16	3132	5.78	0.33	10868
S11	1975	0.01	0	660
S125	1521	148.73	1	5355
	1072	-136.96	-1	4347
	1071	-122.54	-1	4347
U4	1083	-1.06	0	15876
ST RTE 0109	2283	1.49	0	0
S16	2242	0.12	0	2470
	1065	-136.96	-1	13300
S16	2589	1.61	0	1344
S16	1884	0.12	0	3362
S16	2592	1.61	0	1407
U302	3135	5.78	0.33	6725
U1	1060	94.37	1	34828
	1089	-122.54	-1	470569